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GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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VOL. CLXXII., No. 3263.] WEDNESDAY, NOVEMBER 25, 1925. [77TH YEAR.

Queen Alexandra.

THE nation sorrows. A Queen not only in estate, but in heart and mind, passed from among us last Friday evening, having covered a span of life of over eighty years, and having lived among us for upwards of sixty-two years. The innate affection of Queen Alexandra led her to enter into the joys and sorrows of the people with a fullness which can only be measured by the fact that she won and maintained the title of the People's Queen. Gentle, loving, and devoted as she was, she made herself, by unaffected means, an imposing figure in, and part of, the life of the nation, and was a bond of great strength between the people—whatever their position, whatever their political or religious creed—and the Royal House. She has lived and moved so long and so much among us, and loyalty has been reciprocal, that her passing has created a great void. Thus it is the whole nation mourns. Sympathy over their loss flows abundantly from all the people to the King and Queen and the other members of the Royal House—from the people who, as one, feel they have sustained a very real personal loss. She has no further use for those emblems of her royal state, but she has won a crown of pure and enduring qualities in the hearts of the people. More no Queen could desire.

EDITORIAL NOTES.

Sheffield Smokeless Fuel Conference.

THE professional men of the gas industry will observe from the report which we publish to-day of the proceedings at the Sheffield Conference last Friday on smokeless fuel that the subject is rapidly growing in the consideration of men in, and associated with, the carbonizing industries and of those practising in the chemical engineering world. When it is seen that the Conference brought together no less than 350 men from all parts of the kingdom who are directly concerned in the subject, it must impress the technical men of the gas industry with the importance of immediately adjusting their views to the demand of the times for the provision of an acceptable solid smokeless fuel—particularly for the domestic fire grate—or of leaving the work to others, which is unthinkable, having regard to the exceptional position the gas industry occupies not only for production, but for distribution. When a wave of interest is moving, as it certainly is in this direction, it presents an opportunity, the missing of which may mean a loss of an irretrievable character. The gas industry cannot afford to shut its eyes to the present movement, which has behind it men of considerable influence, who have no intention of allowing it to abate until the acknowledged need is adequately satisfied. What is now being done is preliminary to the creation of a position when the Government can be told that there is no need longer to wait for an effective regulation of the use of raw, smoke-creating coal. Time does not permit us to make in this issue of the "JOURNAL" more extended editorial reference to the proceedings, in which the Coke Competition papers were prominent. The part which the Woodall-Duckham Companies took in making that competition possible strengthened the regret that Sir Arthur Duckham was unable, through indisposition, to preside, as had been contemplated; but Sir Frederick Nathan kindly stepped into the breach. This allusion to the importance of the conference will (pending fuller comment) suffice to draw particular attention to the report of the discussion which we publish to-day.

Jubilee of the Southern Association.

THE term "jubilee" seems to invite one to rejoice. There is a genial appearance about the word, fitting for an expression of such delightful meaning. Members of the Southern Association of Gas Engineers and Managers celebrated in befitting manner the jubilee of their organization last Wednesday. They dined and rejoiced together, and heard several speeches panegyrizing the founders of the Association and the men who have, through it, worked for the industry, and wishing that the fine record of the past may be continued for aye. It was an occasion on which the President (Mr. P. G. G. Moon, of Bournemouth) counted it an honour far removed from the category of "ordinary" to be in the chair—especially having, to his right and left hand, men who are representative of the industry's great activities and progress—technical and commercial—and of the industry's organiza-

tions. It was good company, and it was good to be there participating in a function of which the founders half a century ago never dreamed, though they formed the Association on July 15, 1875, with set purpose and definite aims, and did so in the firm belief that it would live and achieve far more than they could picture. Fifty years ahead was a period over which they did not trouble their minds; but, time having spanned that period, we were commemorating what that small band of men then did in opening up an avenue to the growth of distinguished work which has been of vast benefit not only to the members, but to the industry at large. They set a high standard for the then new organization. The maintenance of that standard has become a tradition; and it has been honourably and successfully observed in every particular.

The history of the organization is stamped throughout with the advances which have been made in the industry's technical, commercial, and economic circumstances. Of course, in this connection, the Association has been greatly favoured in its geographical position, with London as its centre, and with many of the distinguished men who have led the industry—being located through professional work in the Metropolis—on the roll of its members, and thus bringing influence to bear in no small degree upon the character of its proceedings. That is an advantage the Association has enjoyed. Looking down the list of Presidents and Hon. Secretaries (as published later in this issue) reminds one of much notably historical in connection with the progress and achievements of the industry. Apart, however, from that distinctive feature, the record is very similar to that of the other regional organizations of the gas profession, all of which have contributed in many ways to the common cause and advance.

As we glance at the doings of the half century, and judgment is made from the standpoint of to-day, two or three things impress us. There are men who say: "If our predecessors could only have foreseen things of "which we now know, in what a different position the "industry would now have been." That is perfectly true; but they could not foresee, simply because their knowledge was not that of these times. Ever since the beginning of civilization, knowledge has been in a state of evolution, and so it will continue to be. The same applies to the gas industry, whether regarded from its inception or from fifty or any other number of years ago. But from whichever aspect we examine its development (although much delayed by the at one time inflexibility of Parliament in respect of their controlling enactments), there is about it an orderly unfolding, which has led stage by stage to our present position. What exists at present could not have been avoided, however long the delay; and it proves what must and will always be proved (whenever apposite) that scientific laws must ultimately succeed over man-made laws, unless these possess the justification conferred by science. In the gas industry's development, the power of organization, unity, and discussion is felt and proved day by day. Those half-dozen men who were the founders of the Southern Association fifty years ago experienced the need of conference over the matters which were then of consequence; 306 men in the Southern area to-day endorse that view. And with greater necessity. Change begets change; development begets development. The matters which have now to be dealt with are more numerous and complex than a few years ago; and as they have progressively become more imposing in number and complexity, so they will continue—thus adding to the responsibility of, and requiring more and more from, the professional men of the industry. Their organization, their discussions, their conferences were needed in the past; they will be more and more essential in the future.

So, having temporarily looked back in the hour of commemoration and celebration, the members of the Southern Association will again look forward, and work among themselves, and in collaboration with their confrères in the other parts of the kingdom, for that technical and commercial advancement of the industry's interests which we all desire to see. While, at the time of jubilee, congratulating the Association upon the past, we sincerely wish the members an abundant success in the future.

Supplies Maintenance in Emergencies.

THE Ministry of Health has issued to local authorities a circular outlining the measures to be adopted for the maintenance of essential public services in times of national emergency. In the document gas undertakings are immediately concerned; and we have no doubt that the National Gas Council will be making investigation into the proposals with the view of obtaining as definite an understanding as possible as to how far coal, coke, and gas supplies will be involved in anything which may be done. There is little question that the arrangements now suggested will be hastened forward, so that the machinery foreshadowed may be in readiness should, unfortunately, the country be thrown into a state of emergency after next April. But the authorities may depend that gas undertakings, so far as their own operations are concerned, will be pleased heartily to co-operate, providing there is no unnecessary or undue interference with their services to the public; and it must be borne in mind in any matter of regulation that the supply resources of gas undertakings are not alike, but vary considerably.

It is true that events in recent years have shown that an industrial dispute may be so extended as seriously to interfere with communications, the conveyance of food and of other necessities, the supply of light and power, and the health and means of livelihood of the population at large. It is also an accepted fact that, while local authorities should keep aloof from any industrial dispute so far as it affects only the employers and the employed in the industry concerned, it is essential that other members of the community should be protected from the dangers and the inconveniences of such a situation as is indicated. Further, it is imperative that protective action initiated locally should harmonize with any national measures that the Government consider it desirable to take. Thus the Government are seeking so to plan that national and local measures may work in concert; but at present only an outline of their proposals is available—the details having yet to be filled-in. The setting-up of new machinery is not contemplated; the intention of the Government being merely to supplement, in times of emergency, the normal methods of communication, supply, and distribution, and to afford those who can help an opportunity of doing so. It is proposed that England and Wales shall be divided into ten divisions, in each of which the Government will be represented by a Civil Commissioner, assisted by a staff. The towns at which the Civil Commissioners will be stationed are: London, Reading, Bristol, Cardiff, Liverpool, Newcastle-on-Tyne, Leeds, Nottingham, Birmingham, Cambridge; and each of the ten divisions is to be divided into suitable areas for administrative purposes.

With respect to the functions of the local authorities, while it appears that it is not possible to draw a hard-and-fast line between national and local service, the position is broadly that the local authorities will be responsible for local public utility services, and will co-operate with the Government in regard to local transport and coal distribution. Full directions will be sent to the local authority as to the supply and distribution of coal. These directions may, if necessary, "limit the supply of coal obtainable for any household or business, and may also place upon local authorities responsibilities for regulating the consumption of gas and electricity within their districts." This would probably necessitate in most cases the allocation of a particular officer or officers by the local authority during the period that the directions were in force. Furthermore, the local authority would have the assistance of a coal emergency officer and of a committee of traders within their district. In addition to a coal emergency officer, there will be in each area a food officer, a road officer, a haulage committee, and a volunteer service committee.

It is satisfactory to find the Government seriously taking in hand the devising and organization of plans to meet conditions which may arise in the event of an emergency. It is more than ever necessary that this should be done in these days of labour alliances, and the projects of extremist labour leaders for increasing the application to the community of the screw in the effort to realize their demands, however unreasonable. The scheme adumbrated is not sufficiently advanced to admit of either

criticism or an expression of unqualified approval. But there can be approval of the principle of adequate prevision and organization for protecting communities in times of emergency. But in the past public utility concerns in times of stress have, in respect of their own supplies, shown such capacity for dealing with the situation that more harm than good might come from any unnecessary interference by any outside authority, however well intentioned.

An Electrical Policy of Caution.

THE closely guarded report of the Weir Committee on electrical development has had its secrets divulged in outline, by Lord Weir himself. He sees no reason for being secretive, for he knows of nothing in the report that is "actually seditious, nor anything subversive of public morality." Lord Weir was in a fine vein of humour when he spoke last Thursday at the annual dinner of the British Electrical and Allied Manufacturers' Association. Among other evidences of his sparkling wit, we find him saying, in acknowledging the ability displayed by the gas industry in publicity and propaganda, that it was only rivalled by the exploiters of "That Schoolgirl Complexion." We do not mind even a flood of jocularity breaking lose from this particular weir, because we all know his Lordship's brilliant talents are accompanied by a lively and genial disposition. Probably at the dinner of a gas organization, he would severely denounce any Government who even breathed of subsidizing the electrical industry at the expense of a great rival industry, which has had to develop its business (as Lord Weir's business has been developed) entirely from its own cerebral and monetary resources, and is still doing so to the advantage of the country. Of course, his Lordship does not know whether the Government will adopt the report of his Committee in its entirety, or will trim it down or expand its features. Because of this he said he would forget the report, and merely state some of his own views on the subject of development. There was laughter; and later the Minister of Transport, Lieut.-Col. Sir Wilfrid Ashley, stated that Lord Weir had laid bare the minutest details of the report.

This being the case, serious consideration may be given to what his Lordship had to say; and what he had to say will in part give satisfaction to the electrical industry, while the remaining part will be assessed variously within it. In the first place we can all agree with his Lordship that effective and efficient development of our national power resources will be ruined if it either becomes a political issue, or is considered from a narrow or parochial standpoint. And no one will oppose his dictum that the power system of this country is a real problem of national equipment; and in its solution the technical characteristics affecting efficiency and economy are predominant. That mirrors precisely what the gas industry has been contending in its protest against the Government giving preferential place and individual consideration to the claims of the electrical industry, and avoiding all recognition of the "various forms of power each with its place," as Lord Weir acknowledges, "in our economic system." While not ignoring those other forms of power, his Lordship has a distinct leaning to the view that we must look to the main power requirements of the country being filled by electrical energy. This being so, he is struck by four outstanding phenomena; and in these, the electrical engineers who have been responsible for the development of the industry will find a distinct reflection upon the methods, and therefore the ability, they have applied in bringing the industry to its present state of (as they have thought) efficiency, technically and commercially. We have heard great boasts as to the improved thermal efficiency of generating stations (in the best ones to between 18 and 19 p.ct.), and of prices for current matching those in other countries held up as an example of what we should do electrically. Lord Weir says that electricity in this country is much too expensive; that we do not use half enough of it; that it should be much easier to obtain; and that we appear to possess inherent possibilities of producing and distributing electricity at a cheaper rate than any other great industrial country. Those "phenomena" contain censure, which the electrical leaders must bear if they cannot satisfactorily dispose of them. It is no use merely putting the blame wholly on the Legislature, who have had nothing whatever to do with the methods of technical and commercial development. But, on the other hand, after his pronouncement as to requirements, it rests upon Lord Weir, as critic-in-chief, to show how an efficiency exceeding that represented by 1·8 lbs. of fuel per KW.-H. generated can be exceeded. That is the best accomplishment in this country to-day, and it is the ideal which the Electricity Commissioners have before them to which to work for the remainder of the country where equal efficiency does not obtain. It is important to remember this in connection with the "phenomena" and the statement that "it is now clearer than ever that the great energy asset of this country—its overwhelmingly important power reserve—is embodied in the coal measures." This being so, the development problem is reduced, to use Lord Weir's words, to "how best we can conserve and convert the coal measures into electrical energy economically and efficiently; and then how to make that energy available at least cost for the industrial and over-populated parts of this country."

Here the native caution of his Lordship comes in. While he does not like to dispel illusions unless they are dangerous and misleading, he does regard it as "a dangerous illusion that British industry can regain unbounded prosperity merely by a drastic change of the electrical power industry." That pronouncement should have good effect in political quarters; for the illusion has there persisted that electrical power is the way—and the only way—by which the ills of industry can be cured, which ills are of a financial order, and include taxation and heavy costs for materials and labour. On the other hand, we can agree that "efficiency in industry, reduction in the cost of our products, with a consequent increase in social amenities, demands, among other things, efficient and economic utility services;" but there may be differences of opinion as to whether "pride of place must be given to electricity." Nevertheless, Lord Weir is convinced that the problem cannot be solved satisfactorily by any drastic or revolutionary scheme, involving the immediate erection of (say) any small number of joint-power stations situated at pitheads, and equipped with low-temperature carbonization or hydrogenizing plant. A great industry cannot be run on an experimental basis. But he advocates that any new electrical scheme or policy should be so devised as to enable coal pre-treatment to be dovetailed into it naturally and accurately when it comes along. A further view is that an important development would seem to be in the generation of electricity by means of waste heat and coke. The interlocking of supplies is also of the greatest economic value. No new scheme, to be of real and practical value, he holds, would visualize the immediate closing-down of all existing power stations, and the abolition of all existing vested interests. A halt must not be called to existing progress; but no sound scheme can fail to realize, and to deal with, the existence of the continual growth of much that every real electrical engineer would sweep away if he could. Regarding the contentious subject of the standardization of frequency, Lord Weir declares this should be done at the earliest possible moment, even if it involves substantial net expenditure. He also exhorted the gas and electricity industries to cease spending money in fighting one another, and to use the money to teach users to obtain both products more cheaply and simply.

In all this, we see little (if what Lord Weir says represents, as the Minister of Transport says it does, the essence of the report of the Weir Committee) which need disturb the gas industry. The real disturbing feature is the action of the Government, which, although an unknown quantity at present, cannot, having regard to public statements on the subject, take any other form than that of giving preferential facilities to the electricity industry for development, although competing with another industry of equal, if not greater, national importance. The effect of any governmental interference with normal development must be—perhaps not permanently, but temporarily—to appreciate the interests of the one, and correspondingly to depreciate the interests of the other. This is a point to which Lord Weir did not pay heed, though underlying what he said as to waste heat and coke there is the view that greater co-operation between the gas and

electricity industries should exist in regard to fuel utilization. A strange thing is that outside the electricity supply industry the opinion seems to be extensively prevalent that it has been developed on altogether wrong lines and needs reconstruction in its chief technical parts, and that it cannot be trusted to run and develop alone. Some of the leaders in that industry, it is singular to note, accept without the slightest demur this view of their past, and rather plume themselves upon the fact that the Government, with their doubtful knowledge of these matters, are taking notice of their work, and are interesting themselves in the promotion of the future of their industry. However that may be, Lord Weir's speech has only whetted the appetite to learn more exactly what is contained in the report of his Committee, and, what is still more important, how far it will be adopted by the Government, and what will be their proposals in giving effect to it.

Co-operative Tar Distillation.

SCHEMES for the sale of tar on a profit-sharing or other co-operative basis have, as shown last week, made great headway in the country; and it is considered by many that it would be an excellent thing if similar plans were applied to the at present uncovered parts of the country. The National Gas Council have been moving in the matter; and there has recently been good evidence of a lively interest in it by the tar distillers. Steps are being taken through the District Executive Boards of the Council to form a Committee to consider the policy to be adopted; and in this connection there has been prepared a helpful memorandum recounting the history of tar co-partnership or other co-operative schemes. It shows that schemes are in operation in nine areas: Bristol, Devon and Cornwall, Midlands, North Wales, Prince Regent (Home Counties), Scotland, South Wales, South-Western, and Yorkshire. The aggregate number of gas undertakings associated with the schemes is 521; and the quantity of tar dealt with per annum by the distillers is approximately 67,500,000 gallons. These figures indicate a large satisfaction over the working of the schemes. Except in the case of one or two of them, the same basic principle is adopted—modified, however, in detail to suit local circumstances. This was indicated in the editorial article published last week, which generally sketched the adopted lines of the agreements. The memorandum prepared by the National Gas Council does this in more definite terms, and also gives in detail the conditions of each scheme.

Balancing Sulphate Supply and Demand.

IN some respects the annual report of the British Sulphate of Ammonia Federation, Ltd., which we published last week, does not make pleasant reading; in other respects there are rays of hope, and cause for congratulation. When a study is made of the statistics presented, it will at once be appreciated that, with the constant upward trend of the output of pure nitrogen, or of sulphate of ammonia, persistent and dogged endeavour is required to maintain equilibrium in demand and output. In this, there is success of a highly gratifying order, through policy in regard to price and quality and keen propaganda. It is abundantly clear that neither one of these means—policy in price and quality or propaganda—would be sufficient without the other to accomplish what has to be done, and will have to be done, to prevent a shortage of demand which would produce a further serious drop in prices. This aspect of the position should not be overlooked in studying the figures which the report presents. It is now a quarter of a century since the Sulphate of Ammonia Committee started propaganda work, which is continued by the Association and the Federation. It was an excellent thing that demand stimulation was taken in hand at that time, for no one then saw what has come to pass, that synthetic and other forms of nitrogen would come along to the extent that they have done. When there was first indication of possibilities, and these were pointed out, there were many sulphate makers who regarded the menace as a bogey; but the data show that the bogey has grown into a very material fact. In the table giving the world's production in tons of 2240 lbs. of pure nitrogen for the year ending on May 31, bye-product sulphate of ammonia was equivalent to 290,300 tons—an increase on the previous year of 15,300 tons. The quantity of synthetic sulphate of ammonia (also expressed in tons of pure nitrogen) was 254,800 tons—an increase of 23,800 tons. Thus the production of synthetic nitrogen represents no less than 46·7 p.ct. of the total. This does not take account of the cyanamide, nitrate of lime, and other forms of synthetic nitrogen, which raised the total production in terms of pure nitrogen to 745,100 tons, which was an increase of 65,100 tons; and the former figure is enlarged to 1,108,100 tons by including deliveries of Chilian nitrate of soda in consuming markets. The 46·7 p.ct. of synthetic nitrogen is significant; and in face of it no one to-day would care to predict when the development of its output is likely to cease. Circumstances alone can determine that. We do not imagine for a moment that the synthetic nitrogen producers are likely to adopt the foolish policy of allowing output so to exceed supply that a fall in prices would make the markets unprofitable.

At the same time, there does not appear to be any immediate hope of bringing the price of sulphate of ammonia nearer to the parity of Chilian nitrate of soda. There is no question that it is the synthetic production that is barring the way; indeed, as to this the report leaves no room for doubt. It tells us that "the position in Germany, the increase in the production of synthetic nitrogen during the year under review, and the further large increase which is taking place at the time of writing, preclude the possibility of the hope being realized for the present." Later we see that "the expectation may reasonably be indulged that the expansion in demand now being fostered may prove sufficient to absorb the output of the new synthetic plants which may be expected to be in operation shortly in Italy, France, and Belgium, and of the extensions of existing plant in Germany and Great Britain." Thus it is that there is little ground for anticipating any early appreciation of prices which would enable sulphate of ammonia to get near parity with nitrate of soda. That this, if it were possible, would make a welcome addition to current prices is seen by the fact that last year the average price paid to Federation members for neutral sulphate of ammonia (21·1 p.ct. nitrogen) was £12 5s. 6d.; whereas the parity of £10 3s. 3d. for nitrate, with 15·5 p.ct. nitrogen, is £13 16s. 8d. for sulphate with 21·1 p.ct. At present then there must be thankfulness if the price of sulphate can be maintained.

Nothing but sheer hard work has kept a fair equilibrium between supply and demand. The effectiveness of the work is shown by the remarkable expansion of the use of nitrogen for agricultural purposes. In the last twelve years, this has increased by no less than 64 p.ct. That, of course, applies to the world consumption, and is an estimate. But one of the tabulated statements shows how an estimated home consumption for agricultural purposes of 40,000 tons in 1913 had risen to 153,200 tons in 1924; and last year saw an increase of 10,800 tons, or 7½ p.ct., in the home demand. Testifying to the balance which is being maintained between the world's production and consumption of sulphate of ammonia are the estimates which appear in the report. They are so remarkably close that there may be excuse for a little surprise. In 1924, the production was 2,472,600 tons; the consumption, 2,463,030 tons. In 1925, the production was 2,725,400 tons; the consumption, 2,725,471 tons. There is no pretence that these are exact figures; but from the information available, they are offered as being "reasonably accurate." We hope corresponding development will continue, until the producers of synthetic ammonia are of opinion that, in their own interests, production limits have been reached. No real measure, of course, can be made of the world's absorbing capacity; but it is clear from the evidence this report puts before us that the Federation must persevere, in the same fruitful way they have been and are doing, with their propaganda work, both at home and overseas. As to the far-reaching nature of this, the report will inform the reader. The makers of 10 p.ct. of the production in Great Britain and Ireland should now reconsider the question of linking-up with the makers of 90 p.ct. in promoting this highly beneficial work, in the results of which there is participation by the 10 p.ct., though not contributing by membership to the outlay.

Those Slippery Roads.

A great deal has been heard recently of the glass-like surfaces which roads dressed with bitumen develop after a short period of use, and which have been the cause of a good many sideslips and accidents. The gas industry maintains that a safer road treatment is by tar; and experience certainly shows that there can be little controversy regarding this submission. Speaking at the luncheon at the opening of the Public Works and Transport Congress and Exhibition last week, Sir Henry Maybury, the Director-General of Roads, appeared to make a side-cut from any mention of the two materials. It is rather a dangerous subject, and is provocative at times of unpleasant discussion. Apparently Sir Henry does not think it is a question of the materials employed so much as the method of using them which is conducive to the production of a glass-like surface. If this be so, then there is not a shred of reason why the home-produced tar should not always be applied in preference to the imported bitumen. What he said was that on the main roads of the country where there is fast lorry and motor car traffic, the surface gets polished after a spell of dry weather. Then when a spell of fog or mist comes, combined with the oil which vehicles deposit, a very slippery mixture is formed. We find that the slipperiness is not only due to the mixture referred to, but is met in dry weather, when, with bitumen, one gets on the roads a better polish than on a first-class ballroom floor. However, it is satisfactory to learn that the road authorities and the Ministry of Transport are quite alive to the necessity of making the roads safe and durable, although the durability (so Sir Henry states) has hitherto been their main objective. The smoothness of the surface is now being corrected; and in all specifications, Sir Henry says, provision has been made for new surfaces to be more mosaic-like than during the past year or two. Probably it would not be necessary to make surfaces more "mosaic-like" if tar was used in a proper manner.

A Fresh Capital-Raising Raid.

From shareholders interested in the part of the gas industry operating in the Newcastle-on-Tyne area, we have received copies of the bombastic prospectus of the Southern Counties Electric Light and Power Supply, Ltd., with offices in London, Eastbourne, Bournemouth, and Exeter! The impertinence of the promoters with their centre at 43, Cannon Street, E.C., knows no bounds. This is revealed in the prospectus itself, and is further attested by their invasion of the district in which electricity generation and supply is held up as a model to the whole electrical industry of the country. As we have mentioned on previous occasions, the Chairman of this remarkable Southern Counties Company is the hardy Baronet, Sir Charles B. H. Soame. The Solicitor bears the name of Thompson; and the Auditors are Turner & Co. How many times the names of these men have appeared on prospectuses with which the 43, Cannon Street, promoting group have been associated, we have not spare time to calculate.

Railway Wages Inquiry.

As large users of the railways, the gas industry is extremely interested in the inquiry which is now proceeding before the National Wages Board into the application of the "N.U.R." for an advance of wages, and the counterclaim for a reduction by the railway companies. This matter has been long pending; and the Wages Board are dealing with it owing to the failure of the Companies and the employees to reach an agreement by negotiation or at the Central Wages Board. The railway companies propose that the rates of the wages of all men employed in London and industrial areas shall be reduced by 4s. a week, and in rural areas by 6s. a week, in consequence of the heavy falling-off in receipts and greatly increased costs. The employees are asking for an all-round increase in wages, which the Companies say will amount, with the other improvements desired, to approximately 45 million pounds a year, in addition to the current wages bill. The inquiry is being presided over by Mr. Harold Morris, K.C., who has succeeded Sir William Mackenzie through the pressure of other duties necessitating retirement.

Interesting Points.

From the evidence adduced at the opening of the inquiry, the following interesting points transpired: The companies' net income was £3,000,000 less in 1924 than in 1913. In 1923 upwards of £1,000,000 and in 1924 over £5,000,000 was taken from reserve to maintain the net revenue. While the total receipts in 1924 were 68 p.ct. over those of 1913, the expenditure exceeded that of 1913 by 119 p.ct. For the first forty-two weeks of 1925, traffic receipts were nearly £3,250,000 below those for the corresponding date of 1924 (itself an unfavourable year). By the end of December, this loss may be something like £4,000,000. The companies' application for wage reduction would save £4,500,000 per annum, though further withdrawals from reserve would be necessary in any event. Contributory factors to the position are general trade depression and the effects of road competition. Expenditure on salaries and wages in 1924 was 153 p.ct. higher than in 1913. The actual wage rates of the men were 100 to 150 p.ct. higher, though the cost of living was only 76 points above pre-war level. The average rate of wage has increased from 26s. 1d. to 58s. 7d.—a difference of 32s. 6d. Before the war the average rate for passenger porters was 19s. 2d.; to-day no man is receiving less than 48s. If the companies' reduction proposals were adopted, the wages in industrial areas would still be 120 p.ct. above the 1913 level, and in the rural areas 110 p.ct. above it. The programme of the National Union of Railwaymen for increases would involve, including concessions to shopmen, an additional £50,000,000 a year.

London Electricity Companies and the Sliding-Scale.

We learn that the Electricity Commissioners have addressed a letter to each of the companies affected by the London Electricity (No. 1) Act, 1925, on the subject of the sliding-scale of prices and dividends therein provided for. The letter informs all concerned that the Commissioners have under the provisions of clause 2 of the agreement scheduled to the Act determined that the date from which the sliding-scale shall come into force shall be Jan. 1, 1926. The Companies are urged to take all necessary steps without delay to fix the standard price for approval by the London County Council, in order that the sliding-scale may come into effective operation at the earliest possible date. The hope is further expressed that, even if it is not found practicable for standard prices to be finally determined before Jan. 1, the Companies will be able to announce such reductions of charges as may be warranted by a forecast of their prospective net revenues and of the appropriations thereof under the new conditions.

Coal Exports.

In the month of October, business in coal for abroad reached the figure of 4,382,484 tons, as compared with 4,932,852 tons in October, 1924. The great recession in the export trade is better marked by the figure for October, 1923, when shipments amounted to 7,432,868 tons. The values of these quantities are correspondingly significant. That for last month is £4,017,907, as against £5,492,046 in October, 1924, and £9,109,867 in October, 1923. Steam coal has been the class to suffer most disastrously. Regarding gas coal, the aggregate shipment last month was 644,351 tons, of a value of £524,821, which works out to an average of 16s. 3·47d. per ton. In October, 1924, the gas coal exported amounted to 650,897 tons, with a value attached of £686,807. In October, 1923, the quantity was upwards of 200,000 tons greater than last month; the exact figure being 845,792 tons, and the value £1,017,646. In the ten months of the year, the total amount of coal sent abroad was 41,847,299 tons (value £42,215,131). In the corresponding period of 1924, the quantity was 51,724,948 tons (value £61,329,652); while in the like period of 1923, the business abroad reached 66,905,810 tons (value £84,050,434). The gas coal exported during the ten months was 5,652,887 tons; the value being £5,329,668. In the same period of 1924 7,075,253 tons were shipped, of a value of £8,139,763; and in the corresponding months of 1923, 7,795,952 tons, of a value of £9,471,140.

Gas Coke Shipments.

The business abroad in gas coke last month totalled to 133,963 tons, of a value of £126,535, which averages 18s. 10·69d. per ton. In October, 1924, the quantity sent abroad was much less, but the value considerably greater. The quantity then was 99,197 tons, having a value of £174,000.

In October, 1923, the shipments were 147,320 tons, of a value of £250,280. In the ten months of this year, the gas coke exports amounted to 570,105 tons, of a value of £646,535. In the corresponding period of 1924, the quantity shipped was 821,037 tons, of a value of £1,438,147. The amount sent abroad in the same period of 1923 was 981,715 tons, with a value attached of £1,569,315.

Sulphate of Ammonia Exports.

The quantity of sulphate of ammonia shipped during October was 26,382 tons, which is somewhat better than the amount sold abroad in October, 1924; the figure then being 25,950 tons. During the ten months of this year, 223,680 tons have been exported, as compared with 226,967 tons in the corresponding period of last year. Spain and the Canaries have made a flight far beyond the sales to them in the like period of 1924. The total of their purchases is 105,275 tons, as compared with 72,800 tons up to the end of October last year. The next best purchaser this year has been Japan with 36,714 tons, as against 50,097 tons in the ten months of 1924. The demands of the Dutch East Indies have declined by between 5000 and 6000 tons; the figure for the past ten months being 18,105 tons, as against 23,788 tons in the corresponding months of 1924.

Tar Products.

The exports of benzole in October amounted to 3923 gallons, as against 1680 gallons in October, 1924. During the ten months, however, we have only shipped 145,149 gallons; while in the same period of 1924, no less than 1,289,187 gallons were sold abroad. In regard to naphtha, 8681 gallons were disposed of in October, as against 4274 gallons in the same month of 1924. During the ten months, 47,918 gallons have been shipped, as against 162,426 gallons in the like period of 1924. As to tar oil, creosote, &c., no less than 3,769,639 gallons were sent overseas, as compared with 4,259,049 gallons in October, 1924. The ten months' business has reached 35,321,649 gallons, compared with 36,030,052 gallons in the corresponding period of last year.

PERSONAL.

Mr. ARTHUR MATTHEWS PADDON, M.Inst.C.E., has been elected a Director of the Commercial Gas Company, in place of the late Mr. H. D. Ellis.

Mr. THOMAS GOULDEN, M.Inst.C.E., of Mill Hurst, Mill Green, Ingatestone, Essex, has been appointed to fill the vacancy on the Board of Directors of the Tottenham District Light, Heat, and Power Company occasioned by the death of the late Mr. H. D. Ellis.

On the occasion recently of the silver wedding of Mr. E. J. Fox, the Managing Director of the Stanton Ironworks Company, presentations were made to him and Mrs. Fox by various sections of the Company's organizations. The principal officials presented Mr. and Mrs. Fox with a silver tray and coffee set; the office staff and outside officials, with a silver fruit service; and the members of the various sections of the Welfare Department, with a silver cigar and cigarette box combined.

Consequent upon the appointment of Mr. C. Bateman to Bath, as already notified in the "JOURNAL," Mr. T. V. BLAKE, at present Chief Chemist to the Cardiff Gas Light and Coke Company, has been promoted to the position of Chief Chemical Assistant to the Engineer, having detailed charge of all manufacturing processes. Here again (as in Mr. Bateman's case) is an instance of a man who has obtained the Institution's Diploma securing recognition. Mr. Blake, who has been in Cardiff since 1919, received his early training under Mr. Hubert Pooley, of Leicester.

OBITUARY.

The death occurred on Oct. 5, at Wanganui, N.Z., of Mr. GLANVILLE DENNIS STONE, who for the past twenty years was Engineer and Manager of the Wanganui Gas-Works. Since Mr. Stone took charge, the output of gas has been quadrupled. Twelve years ago he installed the first continuous vertical plant in the Dominion. The only portion of the original Wanganui plant remaining is one gasholder, which was designed by Mr. Stone while he was in Australia, some years before he went to Wanganui. Deceased was practically the inaugurator of the New Zealand Institute of Gas Engineers, and held the office of President. He leaves two daughters and three sons.

Mr. T. J. ASHLEY, one of the Directors of Messrs. Aldridge & Ranken, Ltd., and formerly Chief Engineer to the firm for 20 years, passed away suddenly on Saturday morning at Broadstairs, where he had recently gone to reside. Mr. Ashley was a man with a wide experience at home and abroad; and his loss is deeply regretted by his colleagues and many members of the gas profession.

We have to record, and do so with the deepest sympathy, the great loss that Mr. S. E. WHITEHEAD, of Portsmouth, has sustained by the death of his wife, on the 17th inst., after nearly a year's illness.

FORTHCOMING ENGAGEMENTS.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

Nov. 26.—MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Autumn meeting at Birmingham.
Nov. 26.—ILLUMINATING ENGINEERING SOCIETY.—Meeting at Royal Society of Arts at 8 o'clock.
Nov. 27.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at the Westminster Technical Institute.
Nov. 27.—NORTHERN STAR LODGE.—Regular meeting.
Nov. 30, Dec. 7.—ROYAL SOCIETY OF ARTS.—Cantor Lectures by Dr. R. Lessing on "Coal Ash and Clean Coal."
Dec. 2.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Visit to the Shipping Engineering and Machinery Exhibition.
Dec. 5.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Visit to Alloa. Paper by Mr. W. Scott.
Dec. 5.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Meeting at Glasgow. Paper by Mr. R. Keillor, of Greenock, on "Surplus Heat."
Dec. 8.—CENTRAL EXECUTIVE BOARD OF THE NATIONAL GAS COUNCIL.—Meeting.
Dec. 8.—FEDERATION OF GAS EMPLOYERS.—Meeting.
Dec. 10.—MURDOCH LODGE.—Meeting.
Dec. 12.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Visit to the works of the Hornsey Gas Company.
Dec. 18.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at the Westminster Technical Institute.

INSTITUTION OF GAS ENGINEERS.

Dec. 2.—Official visit to the Shipping Engineering and Machinery Exhibition at Olympia.
Dec. 8.—4 p.m., Advisory Committee on Education.
Dec. 9.—11.30 a.m., Emergency. 12.30 p.m., Finance.

Glasgow and Solid Smokeless Fuel.—A lengthy and admirably illustrated article describing the Maclaurin plant for the production of solid smokeless fuel, at the Dalmarnock Gas-Works of the Glasgow Corporation, appears in the November issue of the "Industrial Chemist." This system of producing smokeless fuel at low temperatures by the use of internally heated producers was first tried at Port Dundas, and afterwards at Grangemouth. The sole licensees for the construction of the plant are Messrs. Blair, Campbell, & McLean, of Glasgow. The complete arrangement of plant at Dalmarnock is readily followed from the plan of the general lay-out, and the photographic views of various portions of the apparatus which accompany it. This lay-out provides for the eventual doubling of the installation. The plant now described comprises a battery of five units, each unit being capable of carbonizing 20 tons of coal per 24-hour day. It is confidently anticipated that this daily throughput can be increased considerably.

Chemical Bibliographies.—A "Bibliography of Bibliographies on Chemistry and Chemical Technology, 1900-1924," by Clarence J. West and D. D. Berolzeimer, is announced by the National Research Council, Washington, D.C., as their Bulletin No. 50 (308 p., $2.50). This work is composed of the following sections: General bibliographies, abstract journals and year-books, general indexes of serials, bibliographies of special subjects, and personal bibliographies. As the title indicates, the work is a compilation of bibliographies published separately, or at the end of books or magazine articles, or as footnotes to the same, on the numerous aspects of pure and applied chemistry. Each entry gives the name of the author or compiler, the title, and the place of publication. The majority of the entries state the number of references, thus giving an indication of the completeness of the particular bibliography. The entries are classified under the proper subject-headings, alphabetically arranged. An approximate analysis shows that there are about 2400 subject headings, 7500 author entries, and a total of 10,000 individual bibliographies. Though no claim is made for the completeness of the compilation, it is believed that the work will furnish a convenient starting point for any bibliographic search.

ELECTRICITY SUPPLY MEMORANDA.

THE new President of the Institution of Electrical Engineers (Mr. R. A. Chattock, of Birmingham) recently delivered his Inaugural Address. In the course of it, he dealt with the report of the Electricity Commissioners, which document is packed with statistical information, among other things with the performance of steam-generated stations on the basis of "pounds of coal per unit generated." It is rather strange how this basis came to be established, in view of the great divergence that exists in the qualities and calorific values of the coals used. As Mr. Chattock points out, a station using fuel of a very poor calorific value, at a low price per ton, can produce electricity quite as cheaply as a station using high-priced fuel of good calorific value, although the fuel consumption per unit and the thermal efficiency of such a station may compare unfavourably with those of a station using expensive fuel. In view of these and other considerations, the President thinks a better method of comparison would be the cost, rather than the weight, of fuel per unit generated; and this cost would have to take into account the sale of any bye-products, should a process of distillation be adopted. If we may be allowed an expression of opinion, we do not think the suggestion as to cost would be any improvement on the "pounds of coal per unit generated." There are many factors affecting cost. There is the large difference between the cost of low-grade and high-grade fuels. When collieries do more in the way of cleansing the low-grade fuel, it will be found that the difference in cost will be considerably narrowed. Then there are the large variations between the costs of transport, which increase with distance from the collieries; and it costs as much to transport and handle a low-grade fuel as a high-grade one. Then, again, many stations now mix coke with both high and low grade fuel, and thus obtain a better fuel bed and combustibility; and there we have another disturbing factor in the cost of fuel per unit generated. It would be as unfair to make comparisons between stations on the cost basis as on the weight basis. A far better method would be to base comparison on the calorific value of the fuel. This would give the best available comparable comparison, and would avoid the disturbing factors between low and high grade fuel, and short and long distance coal transmission. A station using 2·25 lbs. of 12,500 B.Th.U. coal per unit would generate at an expenditure of 28,125 B.Th.U.; a station using 3·5 lbs. of a grade with a calorific value of only 9500 B.Th.U. would generate at 33,250 B.Th.U. Near to the collieries the cost of the latter might be much less than that of the former; but the expense of carrying the 3·5 lbs. a long distance might neutralize the lower first cost compared with the 2·25 lbs. of higher-grade coal. Therefore, for comparative purposes, the expenditure of heat per unit generated appears to be by far the best basis.

Fuel Expenditure Per Unit.

Mr. Chattock is not by any means smitten with proposals to adopt pre-distillation. He has been studying the current position of the gas industry in relation to its secondary products, which, he finds, has necessitated the—we hope, only temporary—raising of the price of gas. In the first place, the President sees that distillation of the coal to secure these products would necessitate the purchase, transmission, and handling of from 30 to 70 p.ct. more coal; and it would impose additional technical processes (with capital and labour obligations) and commercial responsibilities upon the industry. For what purpose? Even with a satisfactory market for the gas, a serious commercial risk would be run, which might have an adverse effect on the selling price of electricity. The President favours the use of pulverized fuel. He mentions no disadvantages, but all the advantages such as greater efficiency in operation, greater capacity of individual boiler units, greater reliability of the furnaces, accurate control of temperatures, extraordinary reduction in the cost of labour, the efficient use of all classes of fuel—even to the refuse dumps of old colliery workings—and considerable economy, both in capital cost and operation. There are, of course, contras; and when one considers the efficiencies that have been realized in ordinary boiler working, the question is whether pulverization costs, *plus* the disadvantages, will not result in damping-down any accretion of efficiency. There are advocates, too, of the low-temperature distillation of the pulverized fuel before use for steam-raising, but Mr. Chattock is not satisfied on this point. As a matter of fact, he thinks that the electricity industry would have something to gain by the culture of better relationships with the gas industry; and the advantage would be mutual.

Pre-Distillation.

Another interesting point bears upon the load factor. The statistics issued by the Electricity Commissioners disclose that only six undertakings in the country enjoy a load factor exceeding 45 p.ct. For the whole of Great Britain, the combined load factor was only of the order of 28 p.ct. in 1922-23. Recently there has been a reduction in the load factor; and searching round for the causes, Mr. Chattock finds them in the bad condition of most manufacturing industries, reduction in working hours, and the phenomenal increase in the lighting connections in residential districts. But the greatest effect in bringing down the load factor has been the reduction of working hours in factories. This is felt severely by the capital charges of the supply undertakings. The load factor of a residential lighting supply being approximately 10 p.ct., it is obvious that, if this supply is increased to a relatively much greater extent than the power supply, it will have the effect of reducing the average load factor, and increasing the cost of production. In view of this, the President urges supply engineers to do their utmost to foster the use of electricity for cooking and heating; and he suggests that the most telling way of doing this is by an attractive tariff—such as a fixed payment per quarter, and a low price per unit consumed whether for lighting, cooking, or heating.

The Load Factor.

The President does not appear to be enamoured of what is believed to be an important element in the Government electricity scheme—the standardization of frequency and linking-up. To put it concisely, the case he makes out is that, if standardization of frequency is for linking-up purposes, linking over considerable distances would be costly and unprofitable, though useful enough in each district. Standardization of frequency in Birmingham alone, he calculates, would cost £6,700,000; and applying this estimate to the rest of the areas of the country using periodicities other than 50, the estimate for the country would be approximately £27,000,000. This colossal expenditure, in his view, cannot be justified; and, he thinks, if the Government want to develop the electricity industry and to cheapen the cost of supply, it would be far more profitable to spend money on improving the load factors throughout the country. This could be accomplished by electrifying the railways and equipping the coal mines with complete electrical plant for getting coal and for pumping and ventilating purposes. Another point is that trunk lines to connect-up all the large centres of supply would be 1000 miles long; and the cost would amount to approximately £5,700,000. Regarding the submission that such trunk lines would open up the rural districts of the country, he says it is obvious that such large capacity lines could not be safely tapped, except at well-defined centres, and that the opening-up of rural districts must depend upon a network of thin overhead lines radiating from the large centres of supply. The rural demand never could justify a heavy expenditure on distribution, and the greatest care and economy would have to be used in designing such distribution systems. On the other hand, the "Electrical Times" points out that Sir John Snell recently stated that there is spare plant in existence worth 30 millions sterling, which is a great waste of capital for which the consumers have to pay. Of course, a margin of spare plant is, for safety, indispensable to a large supply industry. On top of this, the millions estimated by the President to be required for the standardization of frequency and the provision of trunk connecting mains would considerably add to the financial burdens of the industry. Who is to pay, inquires "Meteor;" and his eyes shift around searching for someone to respond. The piling of millions more capital upon the electricity industry to increase the area of its distributing capacity would perhaps be of more advantage than otherwise to the gas industry, as the additional millions of expenditure would hardly be sufficiently productive to make of it a sound remunerative investment.

Frequency Standardization and Linking-Up.

A few data from the evidence of Sir John Snell before the Coal Commission may be found useful to have on record. Referring to the Electricity Commissioners' analyses and summaries of the returns of fuel consumption and units generated by authorized undertakings and by railway and tramway authorities and certain non-statutory undertakings, he stated that the units generated, the fuel consumed, and the average yearly thermal efficiencies for the last four years showed a progressive improvement. In 1924-25 the units generated increased by 11 p.ct.; whereas the total consumption of fuel was only enlarged by 5·8 p.ct. The Barton Station of the Manchester Corporation is credited with the highest thermal efficiency—19·85 p.ct.; while the average thermal efficiency of the undertakings included in the returns is only 12·45 p.ct. The members of the Coal Commission will be able to contrast these figures with those previously laid before them on behalf of the gas industry, and will be in the position to judge which industry employs coal to the greater advantage. Having spoken of the tendency towards concentration in fewer and larger stations, Sir John Snell stated that the average consumption of steam stations (which represent 95·6 p.ct. of the total output from all sources in 1924-25) was 2·53 lbs. per unit generated on an average yearly load factor of 30·5 p.ct.; but the Barton Station at Manchester only consumed 1·51 lbs. of coal on a yearly load factor of 29·58 p.ct. Sir John has great expectations. Last year the average consumption of electricity per head of the population (excluding private generating

Sir John Snell's Expectations.

stations) was 117 units; but, adding the units generated by private plants, he thinks it is probably in the neighbourhood of 220 units per head. His estimate is that the present output of 7000 million units will grow to 21,000 million units in fifteen years. The total fuel consumed in 1924-25 by the 584 stations was 8,042,242 tons—divided as follows: Coal, 7,892,396 tons; coke, 95,436 tons; and oil, 54,410 tons. A further expectation is that the 21,000 million units which he estimates will be produced fifteen years hence will require 16·9 million tons of fuel; being an average of 1·8 lbs. per unit generated, with an average thermal efficiency of 18 p.ct. All these figures and anticipations appear to include railway electrification. Sir John also made a few non-committal statements as to the Severn barrage scheme. All he had definitely to say about it is that a *prima facie* case has been made out for expenditure on the necessary investigation of the scheme.

PUBLIC WORKS, ROADS, AND TRANSPORT CONGRESS AND EXHIBITION.

Development in Materials and Plant.

On Thursday of last week the Public Works, Roads, and Transport Congress and Exhibition was opened at the Royal Agricultural Hall, Islington, and will remain open until to-morrow, Nov. 26. It is another instalment of a series of combined congresses and exhibitions organized biennially primarily in the interests of local administration. Local government now demands the professional assistance of highly-trained technical advisers and executives, so wide is the range of its activities. Every year the greater development of local needs sees some new responsibility entrusted to certain local authorities; and, as might be expected from the diversity of scientific practice, new theories are being constantly developed by the experience of technical advisers in every branch, and new machinery devised to meet alterations in practice. The present congress may, therefore, well be described as a general clearing-house for such advancements in knowledge. Papers read on the developments in the public services—that read yesterday, by Mr. Thomas Glover and Mr. Arthur E. Collins, on "The Use of Tar in the Construction of Highways," is a typical example—help to maintain the standard of local government at a high pitch of efficiency. At the same time, the principal engineering and other manufacturing firms of the country display the latest improvements in every form of machinery in use in the public services; and this is of great educational value. The number of firms exhibiting this year is larger than ever before; and it is most interesting to note that any profit which may result will be devoted to the founding of a British Chair in Highway Engineering at one of the Universities, to afford scope for more specialized training to meet the needs of present and future students. This public-spirited decision on the part of the Organizing Committee, of which Sir Henry P. Maybury, Director General of Roads, Ministry of Transport, is Chairman, and upon which, it may be mentioned, are Mr. W. T. Dunn, Secretary of the Institution of Gas Engineers, and Mr. J. D. Smith, of Belfast, should provide a great stimulus to the whole congress movement.

ROAD-MAKING MATERIALS.

What impresses one most about the present exhibition is the number and variety of exhibits which relate to the making and dressing of roads. It is only a week or so since the British Road Tar Association, at a luncheon held at Wembley, pointed out the advantages, from every aspect, of British tar as a material for making and surfacing British roads; and it is noteworthy that the Association have an information bureau at the exhibition. It must be confessed, however, that the predominant displays are those of the firms manufacturing bitumen materials. These firms, it is surmised, are exceedingly well backed financially in their propaganda work, and are gathering the fruits of extensive advertising. From the national aspect this is a pity, for every ton of bitumen sold for road-making purposes in this country displaces an equivalent amount of British tar—a material equally satisfactory, and the use of which would tend to increase employment and relieve the depressed state of the iron and steel industries.

AIM OF THE CONGRESS AND EXHIBITION.

The importance of the congress and exhibition was stressed by Sir Henry Maybury at a luncheon given to the Press on Nov. 18. He pointed out that in the year 1922-23, which is the latest period for which complete statistics are available, the total expenditure for all local services was over £346,000,000. Consequently, he said, it was of the highest importance, if due efficiency and economy in administration was to be attained, that officials of local authorities should have the best possible training for their task, that members of these authorities should acquaint themselves with all aspects of the services under their control, and that the general public should be educated to a wider appreciation of all that local government meant. It was the object of the congress and exhibition to fulfil these requirements. The Joint Committee responsible for the organization intended to further the existing facilities for students to obtain the best scientific training; the immediate objective being the establishment of a Chair of Highway Engineering. It was also their aim to provide suitable opportunities for members and officials to meet together at reasonable intervals, to discuss problems and recent developments, and inspect the latest types of machinery and materials. Finally, an endeavour was being made to bring to the notice of the general public the work being carried out on their behalf. Sir Henry Maybury remarked that no fewer than 1315 delegates representing 720 authorities had been appointed to attend the exhibition and congress, and that over 170 firms had acquired space for displaying the newest forms of material and machinery.

THE EXHIBITS.

The different exhibits constitute probably the most comprehensive range of plant and appliances needed for municipal and public work which has ever been staged at one time, and include vehicles propelled by steam, petrol, and electricity, road locomotives, rollers for all classes of road surface, stone breakers, concrete mixers, road paving materials, and tar-spraying appliances. A few notes follow on one or two of the exhibits which, it is thought, may be of interest to readers.

A model of a patent distilling plant for the manufacture of various types of tar—known as "Super" tar, "Vitar," "Tarmulse," and "Tarmex"—is shown by W. & J. Glossop, of Halifax. On the same stand is a 1000-gallon mechanical sprayer, which is self-filling, self-heating, and self-spraying, and which automatically selects the hottest tar for use. The capacity of this machine is 6000 to 7000 yds. per hour. The Mechanical Tar Spraying and Grouting Company, Ltd., of Victoria Street, S.W., have a number of interesting photographs of roads which they have laid. One of the exhibits of Johnson Brothers, of Mark Lane, E.C. 3, is a double furnace tar boiler with Waithman reservoir brooms for tar painting by hand. This boiler is fitted with a preliminary heater from which the tar is pumped into the main boiler, the contents of which, therefore, are not unduly cooled by the ingoing material. The tar is fed by gravity to the brushes. Thomas & Bishop, Ltd., of Tabernacle Street, E.C. 2, are demonstrating their "Cling-Surface" for belts, "Permac" jointing material, "Flexo" leather and textile belting, an oil-reclaiming plant, and some refractory cements. The advantages obtained from treating a belt with "Cling-Surface" are demonstrated on a plant comprising a motor driving a countershaft by means of a leather belt, running vertically, and from the countershaft to a 4-KW. generator by two belts running horizontally—one belt being treated, and the other untreated. The increased efficiency of the former is shown by means of a voltmeter and a bank of lamps. "Tarslag," a combination of cold-blast slag, No. 2 Road Board tar, and bitumen, is demonstrated by Tarslag (1923) Limited, of Wolverhampton, who have a series of photographs of work carried out in this material in different parts of the country. Tarred slag macadam is also shown by Crow, Catchpole & Co., Ltd., of London; Tarmac Limited, of Wolverhampton; W. Prestwich & Sons, Ltd., of Dronfield; and several other firms.

Stewarts & Lloyds, Ltd., of Glasgow, exhibit, among other items, welded and weldless steel tubes for gas, sample joints of the various types, including the "Victaulic," and connections for mains and syphons. Altogether this is an impressive stand. The Horstmann Gear Company, Ltd., of Bath, have an extensive range of automatic lighting appliances for public street lamps. Among their gas controllers, attention is directed to the 3A/UNI, which is a 15-day run quick lighting and extinguishing controller, possessing the feature of instant detachability of the clockwork movement without dismantling any of the gas connections. This model is now provided with a rust-proof solid-drawn steel outside case; and the gas cock embodies a lubricator to the plug, rendering it unnecessary to dismantle it for oiling purposes. Other models exhibited include their patent controller with astronomical dial. This requires no attention beyond winding; the setting of the times of lighting and extinguishing being varied from day to day automatically, to compensate for the difference in time of the rising and setting of the sun. Special weatherproof models for high power suspension gas lamps are also shown. Baird & Tatlock (London), Ltd., have an exhibit consisting of apparatus for testing tar and other material used for road-making; and Hutchinson's Testing Apparatus, Ltd., of Westminster, are showing their instruments used in the control and testing of tars, &c., including the Hutchinson tar tester and gravity gauge as specified by the Ministry of Transport. Penetrometers, thermometers, laboratory sieves, &c., are also demonstrated on this stand. On the stands of Reavell & Co., of Ipswich, and the Ingersoll-Rand Company, of London, are to be found several types of air compressors, both portable and stationary.

CONFERENCE ON SMOKELESS SOLID FUEL.

THE COKE COMPETITION PAPERS.

SHEFFIELD was enveloped in an eye-smarting fog last Friday, the occasion of the conference on smokeless solid fuel organized under the auspices of the Society of Chemical Industry (Chemical Engineering Group and Yorkshire Section), the Institution of Chemical Engineers, the Institution of Gas Engineers, and the Midland Institute of Mining Engineers. Small comfort was offered in the knowledge that the greater part of the Northern Midlands was suffering in the same way; and Mr. W. J. U. Woolcock (the President of the Society of Chemical Industry) was held up in Manchester, and was unable to get across owing to the same cause. The fog, however, which cleared slightly during the middle of the day, but got thicker towards the evening, had no effect upon the attendance; an audience of something like 350 maintaining the discussion to the last. Owing to the unfortunate indisposition of Sir Arthur Duckham, the Chair was taken by Sir FREDERICK NATHAN. A word of praise should be accorded to the Organizing Committee and Mr. H. Talbot (the Hon. Secretary of the Chemical Engineering Group) for the admirable arrangements made for the conference. In an adjacent room in the Mappin Hall of the University buildings was a demonstration of coke burning apparatus There were four exhibits here; three of them burning different grades of ordinary gas coke, and the other a coke oven-coke. Certainly no complaint was to be made against the manner of burning and the heat given off; and we were assured by those in charge that the four fires—two sitting-room open grates, one "Century" boiler arrangement, and an enclosed anthracite type of stove—were all lighted with paper and chips quite easily. The success of the conference may be judged by the decision to hold another in Manchester in February to deal with the question of tar.

Dr. W. RIPPER, opening the Conference, offered a hearty welcome on behalf of the City and University of Sheffield. The University regarded the subject of fuel as of such great importance that they had instituted a Fuel Department under the guidance of Prof. Wheeler. The Conference had been brought together by four of the great scientific Institutions; and it was only by such co-operative effort that a solution of the problem would be found. Dr. Ripper expressed his regret at the absence of Sir Arthur Duckham—who was to have presided—through illness; and at the same time sincerely thanked Sir Frederick Nathan for so kindly stepping into the breach at very short notice.

Sir ARTHUR BALFOUR also offered a hearty welcome to the conference on behalf of the trade and industry of Sheffield. Never was a problem such as the one to be discussed more necessary to the well-being of the country as a whole if they were to keep pace with the competition of other countries, and if, what was perhaps more important still, they were to maintain the standard of living for the workers in this country. This would only be done by a large amount of scientific research, and making better use of the ability and knowledge they had than had been the case in the past.

The CHAIRMAN, in expressing thanks to Dr. Ripper and Sir Arthur Balfour for their kind welcome, said they would all very much regret the absence of Sir Arthur Duckham, who had taken such a keen interest in the Conference. It was a notable one because not only was it held under the auspices of the Society of Chemical Industry, the Institution of Chemical Engineers, the Institution of Gas Engineers, and the Midland Institute of Mining Engineers, but there were also present members of the Coke Oven Managers' Association and prominent iron and steel manufacturers of the district, as well as the heads of the Universities and other Departments which had associated themselves closely with the study of fuel problems.

Mr. GUY RADCLIFFE (Chairman of the Manchester Section of the Society of Chemical Industry) offered the Conference a hearty welcome to continue the discussion of this subject at Manchester in the near future, and said he had been authorized to offer the facilities of the College of Technology at Manchester for this purpose.

The CHAIRMAN said he would like at once, on behalf of the Organizing Committee, to accept with gratitude the kind invitation of Mr. Radcliffe.

MR. W. B. LEECH.

Mr. W. B. LEECH, one of the judges in the Coke Competition, said he was one of the fortunate individuals who had the privilege of reading through the papers that had been submitted in the competition. In the first place, he wished to apologize for the absence of Mr. A. W. Smith, the Manager of the Birmingham Corporation Gas Department, and Mr. Arthur F. Bezant, the Editor of the "GAS JOURNAL," who formed the adjudicating Committee together with himself. They wished him to say that nothing but most important business would have kept them away from the Conference. Referring to the papers in the competition, Mr. Leech said that some in Section I. had been submitted by the staffs of important engineering firms in the gas industry; and he wished to thank those firms for permitting their staffs to enter the competition and give to the industry the knowledge which they had. The absence of any outstanding paper in Sections II. and III., he felt, was to be regretted; and he could only hope that it was due to lack of time and opportunity, rather than to lack of interest. The Committee would have liked the gas engineers to send in more papers. The Coke Competition, occurring as it did at a time when there was some difficulty in disposing of coke, must have stimulated the interest of coke users; and he hoped that interest would not be allowed to die down, now that times were improving. It was indeed a good sign that the Society of Chemical Industry had taken up this matter so fully, because it was to them that a lead must be looked for in this matter of getting coke of a quality which would ensure its ready sale. It would be impossible for him to go into details of the mass of material which had been submitted to the Conference; and he would therefore confine his remarks to a few points. The first question was the purchase of suitable coal. It was suggested in many papers that only coal with a certain ash content should be bought, but the difficulty of doing this would be seen when it was considered that no less than 18 million tons of coal were bought annually for gas-making purposes. It would be very difficult to have all this coal with low ash content. There were not many coals with a low ash content which, if carbonized in vertical retorts on the continuous system, would give a good domestic coke. The ordinary coals which were suitable for gas making usually had a range of from 8 to 12 p.ct. of ash, though he was pleased to say that recent experience showed that this figure was being reduced. His figures had been decidedly better on the average during the last year or two. Other coals could be purchased which could be carbonized in horizontal retorts and would give a coke suitable for commercial purposes and central heating, as distinct from ordinary domestic use in open fires; but he did not think it would pay to purchase coals generally with a more or less prescribed ash content. The next point was the blending of coals; and the only remarks he would make upon this was that he believed it necessary, in order to get a good coke, to blend coals. It might seem difficult at first sight, but it was possible. He had seen coke oven plants on the Continent and in America; and there did not seem to be any difficulty there with blending. As to the preparation of coke, it appeared to him that chemists should be able to give us a good lead, and tell engineers how to get suitable coals. Then the engineers would be able to do their part. At the same time, it was no use salesmen trying to sell coke and to develop a good market if the engineers on the manufacturing side would not take proper care over the grading and quenching of the fuel they were turning out. As an example of what could be done in pushing the sale of coke, Mr. Smith, of Birmingham, had told him that he had recently sent out a number of special salesmen for the purpose of getting coke on to the market for domestic purposes, and in this way he had added something like 2000 new customers for the domestic coke trade. If that could be done by putting out a few salesmen, it was worth doing. Everyone would agree that up to the present coke had been a kind of Cinderella of the gas industry. One of the competitors from Vancouver stated that he had doubled the sales of his coke in twelve months by giving the matter proper attention. If this was possible out there, it was possible in this country; and it was to be hoped that the lessons to be learned from the Coke Competition papers would not be neglected.

The CHAIRMAN said Dr. Lander was unable to be present owing to heavy work in connection with the Coal Commission. He had written expressing his great disappointment and stating that he had sent a contribution to the discussion, which Dr. Margaret Fishenden had promised to read. The subject of low-temperature carbonization was not open for discussion at the Leeds meeting, nor was it the intention of the Organizing Committee that it should be discussed on the present occasion. If it were thought advisable that a special Symposium should

be held on the subject, he had little doubt that one could be arranged.

DR. C. H. LANDER.

Dr. C. H. LANDER in the course of his remarks (which were then read by Dr. Margaret Fishenden) said there were few who would be prepared to contend that in a scientific age they should continue to make use of raw coal as a fuel. Yet, in practice, of the coal used in this country, only a small proportion was subjected to any preliminary treatment—whether with a view to increase in availability, preservation of bye-products, or removal of smoke-producing constituents. The methods practised by the existing carbonization industries had been developed to meet specific demands for gas and metallurgical coke of defined characteristics; and though from time to time improvements had been effected with a view to increasing the efficiency of the processes or raising the quality of the principal products, there had until recently been comparatively little change in the relative attitude towards main products and bye-products. Metallurgical coke works, however, were now realizing the advantages of securing profitable markets for the disposal of surplus gas; and the Gas Regulation Act had afforded the gas industry greater freedom in its choice of methods and processes, with the result that a readjustment of ideas was taking place, and more attention was being paid to the potentialities of the coke yield, particularly with a view to its possible more general adoption for household purposes. Under suitable conditions, either gas coke or metallurgical coke could be used satisfactorily for steam-raising purposes. There was, however (as Mr. E. C. Evans pointed out at Leeds), some difficulty about the successful utilization of coke breeze, though it could be used in conjunction with coal, and had been applied to the manufacture of producer gas. It would not be feasible immediately to substitute coke for coal in any considerable proportion of the vast boiler fuel requirements; but it might reasonably be expected that a gradual replacement would take place. In any case, the efficiencies attainable in modern steam-raising installations were very high, and there were good reasons for believing that both in smoke emission and fuel waste the domestic fire was by far the more serious offender. It was thus imperative that the loss of bye-products at present associated with the use of raw coal in our houses should be checked, and that means for the provision of some cheap smokeless alternative fuel should be developed. The smokeless fuels marketed by existing carbonization industries had long been available, but the consumption of coal for domestic requirements had continued to increase. The explanation for this was to be found in the fact that considerations of cost prevented the complete substitution of gas for coal, though for certain special purposes its use showed every prospect of rapid development; while, on the other hand, gas coke, though cheap, was as a rule somewhat unsatisfactory for household use, except in certain special types of grates and ranges.

The low-temperature process yielded a solid smokeless fuel which was well adapted to domestic use; but unfortunately, though many of the technical difficulties had been successfully overcome, economic uncertainties had by no means been eliminated. Special uses were being found for low-temperature gas; and when fuller information on the subject was at their disposal, developments would no doubt take place in regard to the use of low-temperature tar as a source of chemical products, apart from its use as a fuel oil. But the effects of supply and demand were not easy to forecast; and until the products from full-scale installations had been disposed of in a free market at such prices as might render the enterprise a commercial success, undertakings using low-temperature methods could not be considered to rest upon a sound economic foundation. It was now recognized, however, that the physical structure of a coke, which was determined largely by the coking characteristics of the coal or blend from which it was produced, and the time of carbonization, had an important bearing upon its combustibility; and cokes of high porosity and thin non-graphitic cell wall structure, even when produced at high temperatures, might burn with relative freedom, though the loss in volatiles was bound to react upon the ease of ignition. Mr. Evans, in his paper, dealt in detail with the factors governing the reactivity of coke with oxygen or air, and showed that it was influenced both by the character of the coal carbonized, the fineness of grinding, and the method of carbonization. By the blending of non-caking coals of high gas-making value with caking coals, not only might a dense and easily combustible smokeless solid fuel be produced, but also the throughput in vertical retorts might be increased. The solution of the problem was thus seen to lie either in the production of gas coke of improved quality, or in the overcoming of economic difficulties in low-temperature methods. Whichever would ensue, it would appear that the gas industry, with its existing organization and plant, its familiarity with the technique of carbonization, and its intimate acquaintance with the markets concerned, was the proper agency for its exploitation. The inherent defects of gas coke were frequently accentuated by high moisture and ash contents, and by the practice of selling it ungraded. Mr. Evans had pointed out that close sizing was imperative to make anthracite marketable; the proper grading of coke was of equal importance. Coal cleaning minimized the ash content, while excess moisture might be avoided by dry cooling. If proper attention were paid to these points, gas coke of really good quality should find a rapidly widening outlet for household use. The most suitable process of carbonization to meet the need must depend largely upon local conditions and future advances of knowledge. The solution of the problem, however, might prove to lie, not in any single method exclusively, but in several, each operating in the circumstances most favourable to its particular requirements.

DR. E. W. SMITH.

Dr. E. W. SMITH, discussing the qualities requisite in a solid smokeless fuel for domestic use, said that all intelligent people agreed that if the domestic smoke nuisance could be eliminated, or even reduced, it would be of considerable national advantage to do so. There was a definite demand for a solid free-burning smokeless fuel, in spite of the fact that gas and electricity could, at a price, fulfil all the requisite conditions relative to smokelessness of domestic fuels. Although this subject of the production of free-burning solid smokeless fuel had been discussed on the platform and in the Press very fully indeed, the discussion had been almost entirely confined to new processes unassociated with already existing industries. As a consequence, it had been very difficult for such new processes to prove economical and financially sound. The gas industry and the coke oven industry had been long established, and most of the capital expended on the plant was requisite, not only for the making of gas and other products, but for the preparation of a solid smokeless fuel which, up to date, had been known as coke. The organizers of this meeting, therefore, had for their objective the bringing together of technicians who could (1) indicate the extent to which the gas and coking industries could, with already existing equipment, slightly modify their working conditions so as to produce more suitable solid fuels for domestic use; and (2) thoroughly survey the technique of coking, and by collaboration indicate what methods might be adopted in these two great industries which would enable them to produce a really first-class solid smokeless fuel equal, if possible, to the demands that might be made upon it by the most exacting consumer. It would not be denied that, in many cases, gas undertakings had not laid themselves out to cater for this very definite demand for a solid free-burning smokeless fuel. On the other hand, there were a number of other undertakings, well represented by the Sheffield Gas Company, which did make the most of their coke sales by preparing materials which were clean, well graded, and dry.

In making a study of the qualities that were requisite in a solid smokeless fuel for domestic purposes, one must differentiate between the uses to which the fuel would be put in domestic appliances. The open coal fire grate was only one of the domestic applications of solid smokeless fuel; and subject to correct grading and low moisture content, there was no necessity for coke to be any better than it was at the present day from most gas undertakings or coke oven works for all other uses than the open fire. The central heating boiler, so popular in modern houses, and used for domestic water supply, radiators, &c., worked entirely satisfactorily, and with great advantage, on small coke. The enclosed so-called anthracite fire gave equal satisfaction when using small coke as when using anthracite, and at a lower cost. It was only when they came to the open grates that any question arose as to the suitability or otherwise of gas-works and coke oven coke. From this point of view, much depended on the grate in which the fuel was to be burned. The qualities requisite in a satisfactory solid smokeless fuel were: (1) It shall be smokeless. (2) It shall be readily combustible. (3) It shall be readily ignitible. (4) It shall be low in moisture. (5) It shall not be too high in ash. (6) It shall not be too light and friable. (7) Its price delivered to the consumer shall be no higher than that of satisfactory domestic coal.

The general public, and even technicians, had not realized what was being done, and what could be done, by gas undertakings and coke ovens, to supply the domestic requirements of the nation for solid smokeless fuels. The papers indicated very clearly the possibilities in this direction; and the demonstration of the fires in the Mining Laboratory of the University should bring conviction to the most critical minds. The domestic consumer at the present time required something like 40,000,000 tons per annum. The gas industry and the coking industry together, if the whole of their output were devoted to domestic purposes, could not supply more than 16,000,000 to 20,000,000 tons. There was therefore room for large expansion in both these important national industries; and it was hoped that the results of the deliberations at this and other meetings would assist to that end.

DR. R. V. WHEELER.

Dr. R. V. WHEELER said that the papers by Dr. Lander and Mr. E. C. Evans, and also the Coke Competition papers, all showed a similar trend of thought. They all suggested that, both from the economic and the technical points of view, an improved product from the high-temperature carbonization of coal would result from systematic and scientific blending of the fuels carbonized. The theme which these various writers propounded was that many of the coals subjected to carbonization contained an excess of binder, and that the carbonization of

such coal led not only to an inferior carbonized product, but also to the waste of valuable binding material which might be used for the caking of otherwise non-caking coals. For many years the definition of coking coal had been loosely applied to any coal which on carbonization gave a coherent residue; and it was only in recent times that the importance of the physical structure of the solid residue had received the consideration which it deserved. The idea that the blending of coals would give a coke having certain qualities of combustibility, was based very largely on laboratory experiments; and the suggestions he intended to put forward were in the nature of surmises—the theory being possible of working out only on a large-scale plant. At the same time, there was a good deal to be said for these surmises, because the laboratory work had been carefully done, and the theory had been carefully thought-out. If one studied, as well as was possible with the limited information at command, the probable progress of events during the carbonizing of coal in a coke oven, it would be found that the consensus of opinion was that at some stage in that carbonization—at a fairly early stage—there was formed what had been termed the plastic layer. The coking coal became molten at a certain temperature, and formed what was known as a plastic layer; and the formation of this layer greatly hindered the transference of heat from the oven walls through the charge. The theory was that, if this plastic layer could be eliminated, it would be possible to get a more rapid heat penetration of the charge, and that the charge could be pushed through sooner than was now the case in normal practice. This was one of the advantages which would be obtained from effectively blending a strongly coking coal with a non-coking coal—viz., there would be a definite prevention of the formation of the plastic layer. The best coking coals, particularly, contained an excess of what, for want of a better term, was called binding material above the requirements to produce a good coke. If, therefore, they mixed the good coking coal with a non-coking coal in suitable proportions, the binding material in the coking coal would spread itself over the non-coking coal, and give a good coherent coke without the production of the plastic layer. This was the important point of the theory. Briefly, the suggestion was that the coals should be first finely ground, and then blended; the blend being a good coking coal with a certain proportion of non-coking coal or coke dust. The blend could be charged either as powder or cake. The essentials for the carbonizing plant were that the charge should be uniformly heated through to the centre as quickly as possible; and the methods of achieving this which had been suggested were by the maintenance of high temperatures and the use of narrow ovens, which had been heated strongly so that there was rapid heat transference throughout the whole of the charge—the charge to be pushed out as soon as the centre had attained a temperature of about 700° C. Such a material, when suitably quenched, it was suggested, would be as readily combustible as (say) low-temperature coke. Possibly this was a poor comparison. It would be as readily combustible as ordinary coal, perhaps; and he said "perhaps," because this had not yet been thoroughly worked out.

MR. E. V. EVANS.

Mr. E. V. EVANS, after expressing his appreciation of the excellent papers on coke that had been presented, said many people were striving to get down to fundamentals, and to determine the ultimate cause of reactivity in coke. The papers again showed how complex a problem this was, and that, while a coke might be made eminently suitable for one type of reaction, its value in another sphere might be diminished. The knowledge of the cause of reactivity which was available today was somewhat elementary; but in spite of this, it was the general opinion that by blending one could produce any type of coke required. Substantially this was accurate; but in order to carry out such work adequately, it was essential that they should acquire much more information concerning the cause of reactivity. With this object in view, their first aim must be to standardize the methods of testing. They were beginning to realize the importance of the thickness of the cell wall, the value of cell size, of open and closed cells, of ignition temperature, &c., in determining the efficiency of certain reactions; but they were unfortunately unable to correlate the work of various investigators, owing to the fact that different methods of examination were employed. It followed, therefore, that until these methods were standardized they would waste a good deal of time in talking from different standpoints. No fitter body of chemists than those at the Fuel Research Board could be asked to undertake such work. It was not a difficult matter to devise standard tests for reactivity as shown to the producer and water gas reactions. Both these tests for reactivity suffered from the disability that the fuel undergoing examination must be maintained at an elevated temperature, in order to allow the reaction to proceed. The temperature was such that material containing volatile matter itself changed during the period of examination. A method of testing for reactivity to the producer gas reaction was given in Mr. E. C. Evans's paper; while there was a fairly wide choice of methods which might be considered suitable for determining the reactivity of a fuel to the steam-carbon reaction. By artificially adjusting the inorganic matter present in coke, he had been able to increase the velocity of the steam-carbon reaction to fifty times that of average high-temperature coke. It was, however, a much more difficult matter to determine combustibility, if in that term was included the suitability of the fuel for use in the open grate. An existing method of determining combustibility was based upon the passage of a known volume of air over the fuel and the subsequent examination of the products of combustion. When, however, combustion took place, the test was liable to get out of hand, owing to the exothermic nature of the reaction; and thus attempts had been made to reduce the oxygen content of the air used. So low a concentration of oxygen, however, had been necessary to prevent the reaction becoming unmanageable, that the examination of the products of combustion had become a matter of considerable difficulty.

Many people had been seeking a method for determining the suitability of a fuel as regards ease of ignition, power of recovery, and rate of combustion. He was loth to add one more method of examination to the many that existed; but there was one method which had been evolved in the laboratory of the South Metropolitan Gas Company, and found to be of great use. The principle involved was that air was pulled downwards at a definite rate through a bed of fuel of uniform size. The fuel was ignited at one point; and the rate at which the incandescent zone travelled across the bed was taken to represent the ease of combustion. The main features of the apparatus were the fuel bed, a water-cooled U-tube with orifice meter, and a compressed air injector for creating a down-draught. The fuel bed was contained in a circular iron vessel of 5 in. diameter, similar to a Buchner filter, and was supported on a bed of refractory material. In order to obtain an even distribution of air over the fuel surface, the refractory material was carefully graded by arranging it in successive layers of gradually increasing size; the top layer being of the same size as the fuel with which it was in contact. It was of great importance, when comparing results of fuels, that they should have been sieved to a specific standard; and in this case the standard was 10 to 20 mesh to the linear inch. The gases produced by the combustion of the fuel passed downwards through the refractory material into the U-tube, where they were cooled, and, after measurement by the orifice meter, were blown away by the injector through a spark arrester. The fuel was ignited at a point on the circumference of the iron vessel, and the combustion zone travelled across the bed in the form of a widening arc whose centre was the point of ignition. Experience had shown that the speed of lateral travel across the fuel bed remained constant. By suitably notching the edge of the iron vessel in four places, and starting the ignition of the fuel at one notch, it was easy to make three radial measurements of the distance travelled by the combustion zone. A mean of these was taken to represent the linear rate of propagation; and it was found that this rate depended to some extent upon the speed of air flow, the standard chosen being 1 ft. per second through the fuel bed. The selection of a suitable speed was important in determining the usefulness of the apparatus. Some actual working results which had been obtained in the laboratory were:

Fuel.	Mean Rate of Propagation.
High-temperature coke from various processes	4·8– 6·1 inches/hour.
Low-temperature coke	12 –20 " "
Cocoanut charcoal	19·2 " "
Wood charcoal (4 p.ct. volatile matter)	18·5 " "
" " (23 p.ct. volatile matter)	44·4 " "

This, continued Mr. Evans, was a very simple and crude apparatus; and it had not yet been made into a presentable form. But perhaps the Fuel Research Board would consider the desirability of doing this, as there was much to be learned from its use. One lesson that had been learned was that the phrase "free burning" covered too wide a range, and required a numerical value to be properly appreciated; so that, unless this epithet was used a little more judiciously, they might be led astray in recommending a smokeless fuel for use in the open grate. It had been hinted that there was a good deal yet to be learned regarding the suitability of their materials for the open grate; and he urged them to go slowly in this particular aspect of the matter. If they were to replace raw coal in the household fire, they must not think that the greater radiation effect would recompense the user for the greater difficulty in lighting the fire; and they must bear in mind that a small fire was just as necessary at times as a large one. Finally, they must remember that the human being—especially man—was a forgetful animal who noticed that the fire was almost burnt out only when the room had become cold. These were the real tests for a suitable household fuel; and they realized how wonderful a thing was coal only when they attempted to reproduce its desirable effects. Many samples of solid fuel produced under all sorts of conditions of blending, rate of heating, and temperature of distillation had been examined; and the conclusion had been come to that, if they were to banish raw coal from the household grate, they must place upon the market a fuel that was in every way its equal and in many ways its superior. Unless they could devise a process of manufacture which was itself financially sound, and was not therefore dependent upon a Government subsidy, it would be better to acknowledge defeat, and recommend the abolition of the open fire in this country—thus following the Continental practice. None despaired of finding a solution of this problem, however; and

an immense contribution had been made by the papers before the conference.

DR. M. W. TRAVERS.

Dr. M. W. TRAVERS, F.R.S., addressed the Conference briefly, but we give below a fuller statement by him, as a plea for the scientific study of the chemical and physical principles which underlie carbonization processes and the formation of coke.

Study of recent publications on matter connected with the carbonization of coal leads to the conclusion that a very large number of facts have been accumulated—so many, indeed, as almost to obscure the problem which they are supposed to elucidate—but that, at the same time, we are utterly ignorant of basic principles upon which a knowledge of the process must necessarily be built up. The reason for this state of affairs is not far to seek, and must be attributed to the fact that investigators have generally been ready to assume that the problems of carbonization could be solved by repeated tests on plant, or by small-scale experiments. It is often only too apparent that these merely follow on the lines of productive works operations, and have not been laid out on the basis of a scientific survey of existing knowledge, with a view to reaping full benefit from the scientific analysis of the result obtained. In support of this statement, I may bring forward my own experience in connection with an attempt to place treatment of the water gas process on a scientific basis. In a paper which I read before the Institution of Chemical Engineers on Nov. 5, 1924, I showed that the criterion of accuracy of tests in water gas plant was a balance between the thermal changes in the blow and run processes. By neglecting minor factors, and using simple algebraic analysis, it was possible to estimate, quantitatively, the influence of the important factors such as the CO_2:CO ratio in the blow gas, the temperature of the gases leaving the plant, and the loss in clinkering, on the efficiency of production of water gas. It is admitted that the errors of observation, and uncertainty as to the values of some physical constants, made complete accord between theory and experiment unattainable; but the application of this method to the analysis of results of published experiments showed that the method which had been employed in compiling thermal balance-sheets was misleading in that marked serious error. This fact is made clear by reference to a thermal balance-sheet published in "Nature" in April, 1925, by Dr. Parker. He writes:

> **As an example of a thermal balance-sheet under conditions typical of British practice, the following may be taken from the Tenth Report of the Research Committee of the Institution of Gas Engineers:**
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> | | |
> |---|---|
> | **Heat supplied:** | |
> | **(*a*) Coke to generator** | **4·900** |
> | **(*b*) Fuel to raise steam to generator** | **0·551** |
> | **(*c*) " " " turbine** | **0·643** |
> | **(*d*) Sensible heat of air to generator** | **0·00** |
> | **Accounted for, as follows:** | |
> | **1. Water gas potential heat** | **2 960** |
> | **2. " " sensible heat** | **0·171** |
> | **3. Steam not decomposed (total)** | **0·163** |
> | **4. Blow gas, potential heat** | **1·042** |
> | **5. " " sensible heat** | **0·462** |
> | **6. Heat lost in raising steam, generator** | **0·165** |
> | **7. " " " " turbine** | **0·192** |
> | **8. Heat of steam used in turbine** | **0·446** |
> | **9. Dust, ashes, clinker (total)** | **0·314** |
> | **10. Losses not separately determined, leakages, radiation, &c.** | **0·177** |
> | | **6·093** |
>
> **In a paper contributed a short time ago to the Institution of Chemical Engineers, Dr. M. W. Travers has studied the results of investigations previously mentioned. Dr. Travers is of the opinion that, in addition to the thermal balance-sheets of the type illustrated, thermal accounts should be constructed to show the amounts of heat added to the fuel during the blow periods, and abstracted during the steaming operation. . . .**

Now in constructing the chemical balance-sheet, upon which the above is based, Dr. Parker makes the totally unjustified assumption that the whole of the carbon in the coke, *less* the carbon accounted for as water gas and ashes, must be credited as blow gas, neglecting in this account losses in clinkering, which are not small. From this result he calculates the values of items 4 and 5. Finding that, owing to accumulated errors of calculation, his balance-sheet will not even balance, he added item 10, which should really appear under the heading "arithmetical errors;" the real fact being that items 4 and 5 had already been arrived at by difference. This is not a scientific method of treating a subject; and had the water gas process been made the subject of thorough thermal analysis before the experiments had been undertaken, the object to be aimed at would have been more clearly visualized, and the results obtained would have had a higher value. Thermal analysis of processes is the basis of the study of them from the technological standpoint, for several reasons. In the first place, it is important to ascertain whether it is possible to carry out a process in the manner proposed; and many processes are patented and even tried out on a large scale which would have been condemned at the outset had they been subjected to careful study. The difficulty in the way of treating problems in this manner, assuming that they lie within the limits of the first law of thermodynamics, lies in the inadequacy of existing data. We have, it is true, approximate thermal data covering a sufficiently wide field; but our lack of data is rarely more than an excuse to cover ignorance. When a problem involves studies in chemical equilibria, it is usually possible to evaluate approximation to equilibrium constants on the basis of the Nernst heat theorem. However, it is a fact that the values of the heats of combustion of all gases date back to periods when the technique of gas manipulation was very crude. . . . While we owe most of our knowledge of heats of combustion to the life work of Julius Thomsen, we owe it to his memory not to stop increasing knowledge at the point at which he left off. To our ignorance of the thermal properties of coke, I shall refer later.

In order to estimate the extent of our ignorance, I will consider the process of carbonization in some detail. We will begin at the point at which primary tar is being given-off by the coal. Of the actual formation of primary tar we know practically nothing. It is probable that the decomposition of coal at low temperatures gives rise to compounds of low molecular weight, but highly unsaturated, which rapidly polymerize, and condense as tar fog. It would be interesting to know more of how this process is affected by dilution by steam and inactive gases, and how the fog particles behave and coalesce. A great deal of work is being done on parallel lines in connection with gas warfare, but no one seems to have found time to take up the study of similar processes in connection with gas manufacture. Certainly in connection with low-temperature carbonization the conditions and happenings between the coal and the mouth of the retort are worthy of study. I have searched literature, and no one seems to have touched the subject. There are obviously matters for investigation in connection with the somewhat abrupt transitions which are indicated at comparatively low temperatures, and which are of particular importance in connection with low-temperature distillation; but as coke is to the fore at the moment, I will refer more particularly to changes which take place over the higher ranges of carbonization temperatures. I am always asking the question, What is the mechanism of the evolution of hydrogen by coke in the last stage of carbonization? It would seem that, as the temperature was raised, at each temperature a further quantity of hydrogen was given off, and then some kind of an equilibrium was arrived at. There seems to be no available explanation of such a phenomenon, which must be intimately bound up with some property of the coke. I will not venture an explanation; but I suggest an investigation. Then we come to consider coke itself, and when I say that we know nothing of the thermal properties, or indeed of the general chemical and physical properties of coke, I am bringing a matter to the notice of those engaged in the manufacture and use of coke of which they will have to take notice. I absolutely fail to understand why technical chemists and engineers have always been content to assume that coke is "a sort of charcoal," for, whatever coke may be, it in no way resembles this particular kind of carbon. The study of the gross structure of coke microscopically is valuable and interesting; the determination of combustibility by empirical methods has a certain value, even if the results are often, or even usually, somewhat vague. However, knowledge of the properties of this important substance has been proceeded with so far on rule-of-thumb lines; and if results of real value are to be obtained without excessive expenditure of time and money, science should be brought to bear upon the lay-out and conduct of future investigations.

DR. A. PARKER.

Dr. PARKER, referring to Dr. Wheeler's suggestion as to the blending of coals and the formation of the plastic layer, said that if, as was suggested, carbonization should take place in the centre of the charge at about 700° C., that meant there would probably be no volatile matter in the coke against the wall of the retort, and a certain percentage in the coke in the centre of the charge. The aim, however, was to get coke with an average content of volatile matter of about 3 p.ct., and therefore an endeavour must be made to avoid degrading the coke against the wall, and yet not to leave too much volatile matter in the centre of the charge. This seemed to be one of the great troubles in connection with the production of a uniform fuel; and he suggested not only that it was necessary that a smokeless fuel should be produced which would have an average content of volatile of 3 p.ct., but that, if a piece the size of one's fist were taken, the average content of volatile in that case also should be about 3 p.ct. This was one of the difficulties of external heating. The difficulty with internal heating, on the other hand, was that a large quantity of heat-carrying gas must be used; but he suggested that internal heating should be carried out with water gas, and that this method should be supplemented by external heating. From a careful study of the Reports of the Joint Committee of the University of Leeds and the Institution of Gas Engineers on water gas and thermal balances, and the data given on carbonization at high temperature in the reports of the Fuel Research Board, he had found that if water gas was made in the ordinary way by the intermittent process, for every ton of coke supplied to the generator about 120 therms of heat were carried away—and ordinarily wasted—as sensible heat in the blow gas products. This heat could be applied to the carbonization of coal. This had not been tried in actual practice, but there was no doubt that it could be usefully employed. He had found that, with a properly designed system combining water gas generation with a continuous vertical retort system, it would be possible, with one ton of coke used in the water gas generator, to carbonize 4 tons of South Yorkshire coal and get per ton of coal about 112 therms of gas of a calorific value of 413 B.Th.U. per c.ft., 9½ cwt. of coke (even after supplying the generator), and 9·3 gallons of tar. He put this forward as a suggestion, as there was not time to go into fuller details. In the case mentioned, the efficiency of carbonization worked out to 86·2 p.ct., and the efficiency of gas production to 72·9 p.ct. He hoped later to be able to give further details; but here they had a gas which could be mixed with ordinary rich coal gas in equal proportions, and provide a gas suitable for ordinary town supply. By the adoption of some such process, a smokeless fuel product would be obtained of uniform quality.

MRS. CLOUDESLEY BRERETON.

Mrs. M. A. CLOUDESLEY BRERETON said that, from the point of view of the administrator, there was one thing which emerged from the discussion—that they were, perhaps, to use a much misused word, on the verge of an epoch in the treatment of raw material. There was, however, one big "if" about it—that those concerned should start afresh with an open mind, and yet keep in their subconscious minds the experience of the past. The whole problem had been raised to a new level, and brought into a new atmosphere, so to speak, by this conference and the previous discussion at Leeds, because almost for the first time they had scientists, industrialists, and university authorities meeting together in an endeavour to arrive at a solution. This should raise the whole question out of the confusion of trade interests as such, and bring it to an unselfish piece of research which would, perhaps, change the world. This is what appeared to her to emerge from the discussion and from the co-operation of so many scientific societies, scientists, industrialists, and education authorities.

MR. JOHN ROBERTS.

Mr. JOHN ROBERTS said the publication of the competition papers synchronized with the suggestions which he had made early this month for the production of smokeless fuel at high temperatures in coke ovens and gas plants. In his opinion, the problem of the production of smokeless fuel containing from 3 to 8 p.ct. of volatile could be solved if they would simply eliminate the plastic layer. At the present time it took 30 hours instead of 20 hours for carbonization under high-temperature conditions, because the plastic layer impeded the penetration of the heat. If this plastic layer was entirely removed, he believed the time would be reduced to 16 hours. He was convinced that, if they took a 14-in. oven, and rapidly heated it to a temperature of about 1400° C., using a good blend of coking and non-coking coal, with or without coke breeze, that oven could be discharged when the middle of the charge was at 600° C. As coke ovens had been built for a throughput of 25 tons per day, he saw a prospect of turning out at least 32 tons of semi-coke per oven per day. This, perhaps, did not interest the gas maker much, unless he also happened to be interested in coke ovens; but the gas manufacturer with horizontal retorts or intermittent verticals could apply this system immediately. The conclusions he had come to had been arrived at after a close study of the question for many years and some large-scale work. In connection with this work he had taken a very old oven which normally took 32 hours with 8 tons of coal, and discharged it under the new system in 18 hours. It would have been discharged very much earlier but for the fact that there was a great difference of temperature in the flues at the ends compared with those in the middle, and the result was that even at 17 hours the charge had been over-coked. This emphasized the fact that they were wasting a great deal of energy in over-coking at the present time. With regard to the blending of coals, he was speaking the previous evening to a gas engineer who was drawing his coals from the north-east coast. These were non-coking coals; and he did not wish to draw coking coals for the purpose of blending from (say) Nottinghamshire or Yorkshire. That gentleman was not aware that at present he could obtain his coking coal from the same colliery from which he was taking his non-coking coals. Perhaps this lack of knowledge was not surprising, because the colliery owners themselves did not know it. There were heaps of this coal on the spot which the colliery owners said was worthless.

MR. BIDDULPH SMITH.

Mr. T. BIDDULPH SMITH (President, Coke Oven Managers' Association) said that he would receive very short shrift if he went to his Directors in the present state of affairs and suggested scrapping his plant and putting in a new one designed by the Fuel Research Board or anyone else for the purpose of making a suitable smokeless fuel. Many plants had been on small outputs, and some had been shut down altogether. It would, however, be extremely useful if some method were devised whereby coke oven plants could be changed over to the production of smokeless fuel quickly and without great expense. The importance of blending coals had not been brought home to him so forcibly as it had that morning; and it might therefore be interesting if he mentioned a few experiments he had made some years ago. The coal used was Halifax soft coal; and he had found this to be the best carbonizing coal he had ever had to deal with. At the same time, when carbonizing at high temperatures, he got an inferior coke, and he came to the conclusion that it was super-saturated with binding constituent. Accordingly he carbonized a sample at 1000° C., and submitted the result to a crushing test. He then carbonized a similar sample at 1200° C., but got an inferior coke. Next, he mixed a third sample with 10 p.ct. of breeze; and this was finely ground and intimately mixed. This was carbonized at 1200°, and he got a result half way between the result obtained with the two previous experiments. The next sample contained 20 p.ct. of breeze; and with this he got the best coke of the lot. When he went to 30 p.ct. he got the worst coke of the lot. Thus, that coal mixed with 20 p.ct. of breeze gave a very good result, and one much better than when carbonizing the coal alone. He had come to the conclusion that, if the best coking coals were carbonized in this way, from the point of view of following the modern tendency to obtain maximum output, it was necessary to mix some inert matter.

Prof. A. SMITHELLS suggested, by way of assisting the Chairman to carry through the lengthy programme, that only those should speak in the discussion who had some actual experience and facts to give. It was interesting always to hear clever speculation on these matters, and it would not weary him in the least; but in the interests of time he suggested that those who had sent up their names, and who wished to speak in more or less general terms, might withdraw them in order to give every opportunity for those who were able to give details of actual experience in the matters under discussion.

MR. HARALD NIELSEN.

Mr. HARALD NIELSEN said that, as the discussion of low-temperature carbonization had been ruled out, he would have to speak on general matters. He emphasized the importance of any smokeless fuel which was to take the place of coal being not only easily combustible, but also highly reactive. What people liked to see in domestic fires was flame. By using non-coking coals it was possible to produce a fuel which was far more reactive, and far more easily combustible in the domestic fire, than the ordinary coke from bituminous coal. Moreover, the combustibility of such a fuel depended upon the manner in which it had been distilled. If the products of distillation were removed uniflow with the heat—*i.e.*, the products of distillation were removed in the same direction as the heat travelled—it was possible to avoid the thickening of the cell walls and the deposit of graphitic carbon. If, on the other hand, the heat flow and the flow of distillation products were in counter-current, it would be found that the distillation products, as they passed through from zone to zone, would gradually be affected by the setting free of hydrogen and the deposit of carbon, thus hardening the cell walls and affecting detrimentally the combustibility.

MR. H. HOLLINGS.

Mr. HAROLD HOLLINGS (Gas Light and Coke Company) said there were one or two methods of increasing the combustibility of gas-works coke. Considering first the horizontal retort, there was good reason to believe that, if it were practicable to adopt a smaller retort, an improved coke would result, since with a smaller retort it would be possible to carbonize coal at a lower maximum temperature or with a shorter period of carbonization. In either case, there would be less deposition of tar within the pores of the coke. With a large coal charge being carbonized for a long time, the portion of the volatile matter which was evolved from the centre of the charge towards the end of the long period had to pass through a mass of coke which had already reached a temperature higher than the average temperature in the case of a smaller charge; and this produced an effect similar to, but additional to, the effect produced by the denser packing of the heavier coal charges. Something in this direction had been done, but unfortunately the increased labour and capital charges precluded the adoption of it as a practical method of improving the quality of coke. In vertical retort practice, it was possible to adopt a process similar in principle to one of the processes adopted in making active carbon—*i.e.*, to steam activated coke by admitting a controlled amount of steam into the retort. This was being done in daily practice almost wherever there was a vertical retort. Then there was a further method, which provided much more scope—viz., the blending of coals. In order to blend efficiently, it was necessary to grind coals to a certain degree of fineness. In coke ovens this finely ground coal could be carbonized without any very great difficulty; and he need not venture to prophesy that, if ever the coke oven became popular in the gas industry, it would be in no small measure due to the fact that blended coals might be more readily carbonized in that type of plant. Before blended coals could be carbonized in the existing plants, it was necessary to form the blended coal into briquettes. There were two methods, broadly speaking, of briquetting—briquetting without a binder at a very high pressure, or briquetting with some binder, such as pitch, at a lower pressure.

It was the experience of the Gas Light and Coke Company that, when Durham coals were carbonized in certain of the vertical retorts, the throughput of coal very rapidly fell off in comparison with (say) a selected Yorkshire coal; and in recent experiments it had been found that, if this Durham coal was blended with a non-caking coal and briquetted with a pitch binder prior to carbonization, then the throughput could be increased to the extent of 30 or 40 p.ct. With a selected Yorkshire coal, there was an increase also of from 30 to 35 p.ct., whereas without blending there would be a decrease. In these experiments breeze was not used; the blending was of a caking and a non-caking coal. It must not be supposed, however, that the gas from the plant was increased by 35 p.ct., because the yield of gas from the non-caking coal was less than from the more normal Durham gas coals. Further work was being directed towards the examination of the gas and of the yield of products; but he wished to emphasize that very much more work was required in this direction. He anticipated, however, a number of secondary advantages arising out of this method of carbonization, because it had been observed in the course of the experiments that the output of coke from the vertical re-

torts, when carbonizing briquettes, followed the input of coal much more closely than when carbonizing raw coal. This appeared to him to be important evidence of much steadier working conditions within the retort during carbonization. The coke made by this process was much more combustible than ordinary gas coke. Whether there were horizontal or vertical retorts, however, the coke suffered from the defect that the ash was present in a fairly finely divided state.

Again, this ash question was one which required very much more consideration in connection with coal blending. It would be necessary to proceed very cautiously until it was ascertained how real was the objection to this fine ash, or until some means were found for overcoming the difficulty. It might be that the only way of overcoming the difficulty was to take the ash out of the coal; and in this connection it might be interesting to know that, when making briquettes with pitch, it was not necessary to grind the coal so finely as when making briquettes without any binder. The result was that the ash formed on the combustion of the pitch briquettes was less fine, and fell away more readily than the ash which was formed on the combustion of the briquettes made from pure coal. In making these remarks, he offered no apology for the quality of gas-works coke as compared with furnace coke. The gas industry had not failed to take note of the efforts being made by their friends interested in coke ovens to alter their designs so as to produce a coke which had the same high quality as had gas-works coke. [Laughter.] He could not altogether accept the statement of Dr. Smith that furnace coke was all that could be desired in appliances other than the open grate. As regards the large central heating installations, there might be some truth in the statement; but in respect of the smaller domestic appliances of the closed type, which Mr. Nicol had referred to in his paper, the statement was not true. Gas-works coke was the more suitable for appliances of this nature, for the reason that it was in general—ash and moisture content being equal [Dr. SMITH: Ah!]—slightly more combustible, and so the combustion of the coke in the stove was slightly more easy to control. This, he submitted, was a factor of no small importance when considering domestic appliances.

MR. T. F. E. RHEAD.

Mr. T. F. E. RHEAD (Birmingham) said that experiments were being carried out in his laboratories on the carbonization of briquettes made from ordinary gas coals, using as a binder coal tar pitch. The experiments had not gone sufficiently far yet to enable him to make a very definite statement; but he had come up against two or three points of interest. There was the need for fine grinding, which Prof. Wheeler had mentioned. He could strongly substantiate this, because it was found that a very much better coke could be obtained when grinding considerably finer than ¼ in. mesh, which was the size first experimented with. In this way, it had been possible to get quite a good coke with as much as 25 to 30 p.ct. of coke breeze added to the gas coal; a 5 p.ct. coal tar pitch binder being used for the briquettes. It was noticeable that the finer the grinding, the more pitch was required. Another point was that if the briquettes collapsed too soon in the retorts it made carbonization extremely difficult, and made the retort what was called "sick." When an ordinary vertical retort got "sick," it took 12 to 16 hours to get over it. The coke he was making was rather friable; and he did not know what to do with it. Anyone carrying out experiments on a large scale should avoid making a very dusty coke, because nobody would use it. Another matter which had emerged was the need for standardized tests of the physical and chemical characteristics of coke. He felt that a test was needed which did not require the breaking of the coke to a very small mesh. What was wanted was a test which would deal with the coke as it would be used on the domestic grate; and experiments in this direction were being carried out in Birmingham.

MR. DOUGLAS RIDER.

Mr. DOUGLAS RIDER said he was glad that coke quenching had been made a special subject, because a properly quenched fuel was of as much importance as a properly carbonized fuel, whatever might be the purpose for which it was required. It was futile to spend many thousands of pounds upon research, and many more thousands in the production of an ideal solid smokeless fuel, if, on arrival at the open firegrate, it was found that it could not be ignited because of its high water content. Efficient quenching, therefore, was a *sine qua non* in the successful exploitation of a domestic fuel. Not only from this point of view, however, was it necessary to ensure efficient quenching if water was employed. It had been authoritatively stated that where water was brought into contact with red-hot coke, the sudden generation of steam caused explosions which fractured the coke and increased the percentage of breeze. This was obviously unsatisfactory, and should be avoided if possible. In these circumstances one naturally inquired whether it was desirable to use water at all; and the reply would depend a good deal upon the angle from which the subject was viewed. In the past, liberal water quenching had been a godsend to those producing coke either in gas-works or in coke oven works; and it made one blush to think of the thousands of tons of water which had been sold at anything from 20s. to 70s. per ton. Fortunately, both in the national interests and also in the interests of the fuel producers, buyers were realizing that they could no longer afford to pay such high prices for dirty water. This meant that the receipts from the sale of fuel would be less, and would lead to better efficiency and the production of a superior product. There were many coke producers who claimed that wet quenching was essential, as it was the only way in which they could dispose of their waste liquor. They had tried dumping it in a near-by trout stream, but had been found out. Even if furnace coke users had not objected to the coke treated in this way, the domestic coke user very soon would. At a meeting such as this, where so many learned bodies were represented, liquor-quenched coke should not be countenanced for one moment. If, however, water quenching was the only method available which was sound technically and commercially, they could at least ensure that it was applied scientifically and economically. Fortunately, the indiscriminate use of water through the medium of the hose pipe was now being done away with in all modern carbonizing plants, and a serious attempt was being made to control accurately the amount of water employed to quench a known quantity of coke. Several post-war methods had been devised for this purpose. He was definitely in agreement with those authors who stated that the ideal system was one which not only ensured the minimum consumption of water, but which eliminated any possibility of the acid-laden steam coming in contact with the retort or oven iron and steel work.

The ideal system must also ensure that no water came in contact with the lining of the oven or retort, and that the conditions under which the operators worked were as amenable as possible. In his paper on coke preparation, Mr. Birks had described a system in which the hot coke was transferred by various mechanical means to a quenching tower, away from the carbonizing plant, where a fixed quantity of water was applied. Some such system as this was already employed in modern coke oven installations, and he had no doubt that it would be extensively employed in gas-works practice in the future. If this system was adopted, it was essential to ensure that the coke was transported from the carbonizing chamber to the quenching tower in the shortest possible time and by the simplest means, because it was in this section of the plant that most of the wear and tear took place. A coke car hauled by an electric loco was probably the easiest and simplest way of achieving the desired end; and it was interesting to note that at the works of the Carnegie Iron and Steel Company in America, where there was an installation of 366 coke ovens, one of these coke cars received a charge of hot coke, transported it to a quenching tower, delivered it on to a wharf after quenching, and returned to the ovens for the next charge, in just over five minutes, doing 11½ circuits an hour, and maintaining this speed throughout the day. It handled 6½ tons of coke per charge; and the cost of the car and loco was about £4500. They must also remember that quenching within the tower was not complete in itself, and that the coke should afterwards be discharged on to a wharf where any hot spots might be dealt with before the fuel was delivered on to the band conveyor for transport to the screening station. There were several other ways in which coke could be efficiently water quenched; but in his opinion the one just referred to was most likely to give the best results.

Considering whether there was a commercially sound alternative to water quenching, Mr. Rider said that reference had been made to a method which was being successfully worked in those gas-works where continuous vertical retorts were in use. Here steam was employed for quenching the coke before it left the retort; and the quantity used could be so controlled that, when the fuel was eventually discharged, it contained not more than 1 p.ct. of water, and was sufficiently cool to prevent firing. The use of steam in this way served a double purpose, for the heat recovered from the coke was utilized within the retort to produce water gas. The amount of steam required for quenching would probably be equal to 10 p.ct. of the coal carbonized, and the yield of gas from the retort would be increased by 20 p.ct. This method was of no use where the carbonizing system was of an intermittent type. To meet the requirements of this type of plant, several references had been made to a system where the hot coke was transferred to an airtight chamber, and was cooled by passing inert gases through it; the gases in turn being cooled by the transference of heat to a boiler plant before being returned to the coke chamber. Several patents had been taken out along these lines, and at least one system seemed to be working satisfactorily on the Continent at the present time. There appeared to be one serious objection to this method of quenching as employed to-day. This lay in the variation in the temperature of the inert gases leaving the cooling chamber hour by hour, particularly in the smaller plants, where there was a considerable interval between each charge of hot coke. This variation meant a variation in the quantity of steam generated; and if it was employed on the works for power purposes, the variation might be sufficiently serious to prohibit its use. If some method could be devised—and he understood a process had already been worked out, but not yet published—whereby the temperature of the gases remained constant throughout the day, the objection he had raised would be overcome. As at present designed, this method of quenching involved the raising of steam in order to cool the gases sufficiently quickly, and

keeping the size of the plant within reasonable limits, which was satisfactory so long as the steam thus produced could be usefully employed. At most modern gas-works a considerable amount of steam was already being raised by utilizing the sensible heat in the waste gases leaving the carbonizing system; and it could be produced much more cheaply than by the coke cooling system. If the works requirements were capable of absorbing the steam from both sources, the coke cooling system might be employed successfully from this point of view. If not, then some other means must be found of utilizing the heat contained in the inert gases leaving the coke cooler. It had been said that the high capital cost of the dry cooling system prohibited its general use and outweighed any saving effected in operating cost; but he was not yet satisfied that this was really so. It seemed that everything depended upon local conditions and the requirements of individual works, because so many different factors had to be considered It had also been stated that the process was not suitable for the average size gas-works or coke oven works in this country; but here again he was not yet convinced.

In a preliminary investigation which the Research Section of his Company had been making, the following information had been obtained. Taking an average size gas-works carbonizing 160 tons of coal a day by any of the known intermittent systems, and assuming that the total amount of steam used on the works was equal to 10,000 lbs. per hour, approximately 5650 lbs. could be raised by waste-heat boilers at cost of about 10½d. per ton of steam. The approximate capital cost of the plant would be £2500. The remainder of the steam required —namely, 4350 lbs.—could easily be raised from the waste heat in the coke, at a cost of about 3s. 3d. per ton. The approximate capital cost of the plant would be £8000. This gives an average cost of 1s. 11d. per ton of steam on the works, and a total capital cost of £10,500. These figures had to be compared with what the cost would be if the ordinary works boiler were used. This would, of course, depend upon the form of plant, the type of fuel used, and the price at which it was charged; but generally speaking there seemed a case for combining these two methods of steam raising where the total steam produced could be efficiently utilized.

Mr. Rider said he was of the opinion:

(1) That liquor quenching should be abandoned.
(2) That steam quenching would depend upon whether continuous verticals were otherwise suitable for producing the fuel required.
(3) That local conditions and requirements would determine whether water quenching or dry cooling was most suitable.
(4) That, if water quenching was adopted, the quenching tower system placed away from the carbonizing plant would probably be the most suitable.
(5) That the coke car and loco was probably the cheapest and most satisfactory means of conveying the coke to the tower.
(6) That, if dry coke cooling was employed, there must be an outlet for all the steam thus produced, in addition to the steam obtained from the waste-heat boiler plant, or, alternatively, there must be another suitable outlet for the heat in the inert gases.
(7) That dry coke cooling would not be satisfactory unless the temperature of the inert gases going to the boiler was constant, and the quantity of steam produced was uniform throughout the day.

Mr. F. M. BIRKS then gave an abstract of his winning paper in the Coke Competition, on "Coke Handling, Screening, and Breaking."

MR. RALPH HALKETT.

Mr. RALPH HALKETT (Sheffield) said it had always been the policy of his Company to cater both for industrial and domestic uses of coke. As far back as 1888 they began to grade and screen coke. At that time the Company had a hand screening plant, which gave three different sizes of coke. Two or three years later experiments were carried out to get a better system of grading. The plant then devised gave good results, and at the present time a similar plant was in use, with but a few alterations. Two or three years ago, Messrs. Woodall-Duckham put in a mechanically operated screening plant, which he believed was one of the best in this country at the present time. With this plant he was able to get seven different grades of coke; and it was his firm opinion that it was only by grading coke that stocks would be reduced. There was a danger that the industry was inclined to take this matter too easily, and to supply coke to the customers as it was discharged from the retort. This coke, however, was not fit for domestic use; and if the gas industry was to get the domestic trade, it would be necessary to grade the coke and supply it to the customers in the size required. For a considerable number of years coke of the "apple" size had been pushed for domestic use; and it was only recently that he had gone over to what was termed "walnut" size. During the past few weeks he had adopted a scheme for the delivery of two bags of coke and upwards to domestic users; and he was delighted with the results. There was undoubtedly a big field for all gas undertakings in this direction, if they would only cater for it. As the result of the exhibition in the showrooms in Sheffield of the coke in question, 200 bags were sold on the first day. This had now gone up to 500 bags per day; and it was impossible t keep pace with the orders at the moment. There was a fleet of 30 to 40 motor vans continually giving deliveries, so that it was developing into a big business. By grading the coke, he believed it would be possible for gas undertakings to dispose of all their make locally. It must not be overlooked that the price of coke more or less governed the price of gas. There had been experience of that quite recently, when a number of gas undertakings had to increase their prices for gas due to this. Therefore he impressed upon gas undertakings the necessity for putting their house in order and catering for the domestic coke demand in a manner which would increase this demand.

MR. H. G. HIRD.

Mr. H. G. HIRD remarked that the points he wished to raise involved the question of low-temperature carbonization, though the discussion of this had been forbidden. All the papers, however, showed the importance of a quick rate of carbonization to get a more suitable fuel. He had carried out experiments in the laboratory, and these had been continued on a semi-commercial scale which had been in operation for six months. The plant, which had been built to carbonize 10 cwt. of slack per charge, was designed to maintain passage ways down the centre of the coal charge for the quick exit of the gases and products of carbonization. This was done by means of a special shaped rotating blade, a diamond shape cross section having been adopted as affording the best results. It had been found that these blades had kept free of carbon deposit during the six months they had been working, and that they had been unaffected either by heat or the products of carbonization.

MR. HORACE CHAMBERLAIN.

Mr. HORACE CHAMBERLAIN said that the general trend seemed to be to put all these abstruse problems on to the gas industry. While the gas industry would not jib at this, he felt that a good many of these problems should be tackled also by those who are indirectly connected with the gas industry. In the first place, as regards the cleaning of coal, it had been suggested that the coal should be cleaned at the gas-works. He did not agree with this. Dr. Smith had mentioned that the objection to buying washed coal was the cost of the carriage of water from the pit to the customer. The same thing applied to the ash. Next, as to the volatile matter in the coke. Personally, he did not believe that, to have a readily ignitible coke, it was necessary to leave any volatile matter in it at all. Certainly it could be made better use of than by being sold at 1½d. per therm. A gas-works was essentially a gas-producing concern, and, incidentally, a coke-producing concern. Therefore, any experiments carried out to improve coke should run parallel with experiments to improve the gas. He was not satisfied that the correct composition of the gas had yet been determined to suit all the purposes to which it could be put. A good deal of work must be done quickly in this respect. The blending of coal was an interesting problem and one which had been tackled to a small extent in Sheffield. The coke fires which were being exhibited had been lighted with paper and chips; and if this, as he understood, was one of the disadvantages of using coke—*i.e.*, difficulty of ignition—it had certainly been overcome. An important point in connection with ignitibility was low moisture content, even more than low ash content. This brought him to the quenching of coke. While it was possible, when quenching coke with a hose pipe, to get the moisture content down to 7 p.ct., he would like to get lower than this; and he believed it could be done if the question was properly tackled. He did not think the Sheffield coke exceeded 7 p.ct. of moisture; but dry quenching was a method which he would very much like to see put on a commercial basis. Up to the present there had not been a really sound proposition put forward in this regard. The same thing applied to the washing of coal. The wet process had a disadvantage; and if the colliery people could adopt a dry cleaning process it would be very acceptable, and would help both the users and the colliery owners. When the whole problem came to be considered, it must be realized that the substitution of a smokeless fuel for the coal now used for domestic purposes alone was much too big a subject for any one industry to tackle. At the present rate of progress it would take 20 or 30 years before the coke oven industry and the gas industry could produce sufficient smokeless fuel to satisfy the demand for domestic purposes alone. Therefore, it was necessary that there should be co-operation between the two industries and any others that might be interested. A point made by a previous speaker—that over-coking should be avoided—was of importance as affecting not only the coke produced, but also the tar and gas. The one thing at which he had been disappointed at the conference was that no information as to a reliable method of testing the combustibility, ignitibility, and reactivity of coke had been given. Such tests, as had also been remarked, should be carried out on the sizes as supplied to the customer. There was no advantage in taking a sample of coke and grinding it down to a powder, and then, after determining its properties, saying that these were the properties in the coke as supplied to the customer.

PROF. J. W. COBB.

Prof. J. W. COBB remarked that thanks were due to Sir Arthur Duckham, to the "GAS JOURNAL," and to the gentlemen who had acted as adjudicators in the Coke Competition. It seemed to him that there was a new vitality with respect to the whole of this subject, due partly to the fact that the public conscience had been aroused against the conditions which produced dirt and fog, and partly because of the technical interest which was being taken in the processes of carbonization, which must have the effect of putting things on a different footing. That technical interest might be said to be centring on the point that the old definite and dogmatic correlation between the properties of the coke and the temperature of carbonization had gone. They now knew that it was a much more complicated matter than this, and new factors which were under control were coming into play, though they were still imperfectly understood. Among those factors was heat transmission; and fundamental research of that kind was being undertaken at Sheffield and elsewhere. What those who were doing this work were particularly concerned with at the present time was to take one class of coal and see what were the differences that could be made in the rate of heat transmission and in the character of the coke produced by various blending and sizing operations, on a semi-working scale. One of the difficulties was that of being unable to make a satisfactory comparative test between the cokes so obtained. He did not believe that one test or one kind of test would provide a solution to this difficulty. If they considered, for example, the influence of the tarry matter left in a coke, and the different uses of the coke, it was obvious that such tarry matter might hamper the reaction between carbon and CO_2, filming the carbon as it were, and closing up the pores. This might be the case for industrial processes. On the other hand, if they were considering combustion, then the tarry matter might have a prohibiting or a stimulating effect so far as combustion and ignition were concerned. The same test could not be applied for these different conditions; and he confessed that he was at a loss to know what type of test to apply in the work of producing a domestic coke which was now going on. Finally, Prof. Cobb said that in burning these smokeless fuels it was essential to bear in mind that there was a greater difference in the manipulation of the dampers for the purpose of keeping the fire going than was the case when dealing with coal in an ordinary grate; and this would be an important factor in bringing smokeless fuel into the position in which they all hoped to see it.

MR. A. L. JENNINGS.

Mr. A. L. JENNINGS said that, while several speakers had referred to the necessity for the preparation of coke to suit the particular market, none of them had mentioned the possibility of still further improving the prospects for its sale by washing it. In the case of his own undertaking, he produced about 12,000 tons of coke per annum, and as much as 750 tons of washed coke were sold locally at a price which was always 50 p.ct. above the ordinary price of coke. He believed that coke ovens very often had a breeze which they called "ballast;" but if it were graded, and the large pieces taken out and washed, he believed there would be a good market for it which would very materially improve the income from the coke side of the business. In the case of anthracite stoves, he believed that washed coke would be found to be very much more satisfactory than ordinary coke, and would entirely take the place of anthracite. The washing of coke need not necessarily be expensive. In his own case he broke the coke for domestic purposes, and at the same time made washed breeze. While he got 25s. a ton for unbroken coke and 27s. 6d. for broken coke, he was able to get as much 37s. 6d. per ton for washed coke. The cost of doing this, including labour, water, power, and other items, not including interest and sinking fund, was 7½d. per ton of the material at the intake end. In the case of those undertakings interested in the recovery of pan ash, he mentioned that this plant was capable of being switched-over from the one process to the other. They broke coke for domestic purposes, and had in conjunction with the breaking plant a "Retriever" coke washer which washed coke at the same time as the ordinary broken domestic coke was being made.

Mr. RALPH HALKETT said that, as Mr. Jennings had mentioned washed coke, he would like to say that the Sheffield Gas Company had always done this; they washed a considerable percentage of the breeze. For certain purposes it was washed to remove shale and other inerts. Both hand and mechanical methods were employed for doing this.

Sir FREDERICK NATHAN, in closing the Conference, said that the Organizing Committee had accepted the invitation of the Chairman of the Manchester Section of the Society of Chemical Industry to hold a Symposium in that City; and the date had been fixed for Feb. 19, when the subject of tar would be dealt with.

A cordial vote of thanks to all those in Sheffield who had helped to make the Conference a success was passed on the motion of Mr. C. S. GARLAND, Chairman of the Chemical Engineering Group and also of the London Section of the Society of Chemical Industry.

The Conference closed with a hearty vote of thanks to Sir Frederick Nathan for presiding.

MR. H. J. TOOGOOD.

Mr. H. J. TOOGOOD, of Elland, forwards, Nov. 21, 1925, the following remarks, which, owing to lack of time, he was unable to make at the Conference:

(1) Dr. Lander's and Dr. Fishenden's paper stated: It is difficult (owing to the high cost of the necessary distributing mains) to erect super-gas-works at the collieries, and distribute the gas to the towns. I submit that the governing factor is coke (not mains). The freightage of coke, being less desirable and more costly than the freightage of coal, economically precludes the gas-works being at the collieries. Natural gas (having no coke residue) is, and has been for years, economically conveyed very long distances.

(2) *Smokeless Fuel.*—On reading the various papers, one is struck by the unanimous case made out for the blending of cleaned coals. Also, it is inferred that gas-works should undertake this work; but surely the ash and impurities must be taken out at the collieries, in order to save freightage. Further, as economy will probably ensue by simultaneously grinding, washing, and blending, this should be a colliery enterprise, and might easily give a new prosperity to the coal trade.

(3) With regard to the published prize papers in this Coke Competition: Generally one is impressed by the concord of opinion as to what ought to be done to improve the coke sales, but there is little shown in the way of novel design of new plant to achieve the end in view. I consider that all gas-works from now onwards should grade and wash at least a proportion of their coke for household smokeless fuel, so as to create a demand, as time is a factor of progress.

(4) Dr. Parker raised the theoretical aspect of combining external and internal heating of the coal charge under distillation. One practical application of this ideal is given in the published papers of the Coke Competition.

(5) *Popularizing the Use of Coke.*—All are agreed that, relatively to Continental peoples, we British are stubborn in our habits against the use of coke. The most fertile time and place to lay the seeds of rectification of this national fault is in our schools, particularly the infants' schools. I therefore suggest that for national good, all schools should "taboo" entirely the coal fire, and adopt forthwith coke fires, so that the young ideal may instinctively be led to the blessing of a purer air, and a love of the radiant energy of sunshine, and thereby reap the economies in health and treasure now lost to this generation through the demon smoke.

(6) *Coke Fires.*—An interesting point has been raised as to the possible advantage of iron in the ash of coal, and the part it plays in increasing the reactivity and combustibility of coke. The thought occurs—perhaps our grandmothers, who swore by putting the poker in the fire, had after all more wisdom than whim in their philosophy, for a red-hot poker used when kindling a fire may not only have a catalytic action, but may act mechanically as a heat conductor to speed up reactivity. As another example, consider the brightness of the watchman's coke fire in his iron bucket.

(7) Finally, I consider this Coke Competition and Smokeless Fuel Conference have aroused national curiosity; and if we are to hold that interest, we must distil our ideal down to a slogan; and I would suggest that we take the universally-known slogan, and remove the letter "F" from "fire," so that the truism "Where there's smoke there's fire" should henceforth be known as "Where there's smoke there's ire."

Usefulness of Graphic Charts.

Some of the uses in the gas industry of curves, or graphic charts, have been explained by Mr. B. R. Carney, of the Northern Indiana Gas and Electric Company, Hammond (Ind.), in the pages of the "Gas Age-Record." A chart shows the proper relation of figures with great speed and absolute accuracy. A $10,000 increase in a month may be excellent; the same increase spread over three or four months is not so good. Our mental processes do not register this condition accurately; but the changing slope of a curve will make it at once apparent. To take only one of the directions in which charts prove beneficial, the plant superintendent can use to advantage a chart showing the output by days over a period of a year or more. Such a record will be useful in estimating peak days in advance. A temperature graph along with this chart will add to its usefulness. In most plants a daily report of some form is made. This gives the foreman results covering one particular day, but does not provide a comprehensive or connected review of figures from day to day. On the other hand, any monthly report which may be made is history by the time the figures are completed. For close control of operating figures, cumulative data should be kept and charted. Each day's figures should be added to the total for the preceding days of the month. From these totals, important unit figures may be calculated and charted. In this way the foreman knows just where he stands. He has a knowledge of operations as a whole, and does not have to draw his conclusions from a group of disconnected daily reports. In the distribution department chart records are of value; while to the manager in charge of operations they render two services. From them he can learn at a glance the results being obtained. The completed charts, supplemented by a little good judgment, are an excellent basis for budgeting future operations. An operating budget is valuable only if worked out logically from sound basic assumptions; and no matter what form the budget may take, the basic assumptions may best be determined with the help of curves showing past results.

SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

GENERAL MEETING IN LONDON.

LAST Wednesday, at the Hotel Cecil, Strand, W.C., the Association in the afternoon had their autumn general meeting, and in the evening a dinner to celebrate the Jubilee of the Association, which was formed in 1875. The day was a successful one in every respect; and in its course, many honoured names in the industry were mentioned. The Association has been well served, and by none better than by Mr. PHILIP G. G. MOON, F.C.S., of Bournemouth, who, as President, occupied the chair throughout last Wednesday's proceedings.

CONFIRMATION OF MINUTES.

The PRESIDENT proposed, and it was agreed, that the minutes of the last meeting as published in the "GAS JOURNAL" should be taken as read and confirmed.

THE NEW PRESIDENT.

The PRESIDENT said they now came to the important matter of the election of a President for the ensuing year; and it was the privilege and pleasure of the outgoing President to propose his successor. The gentleman he had to propose for the position was their esteemed friend Mr. Robertson, the Engineer of the Bristol Gas Company, of whose work as Vice-President during the past year he could speak feelingly. Mr. Robertson would make an excellent President, and would uphold the best traditions of the Association. He always remembered Mr. Robertson as the man who told them he could not speak—in terms so eloquent that he failed to convince his audience. They all knew him, in addition, as an able engineer, a good administrator, and one in whom they could have every confidence as their future President.

Mr. PERCY S. HOYTE (Plymouth) said he was delighted to second the proposition, for they in the West knew Mr. Robertson perhaps better than others did. He was the Engineer of the most important gas undertaking in the West of England. Had they known that their old friend Mr. Irving, who was Mr. Robertson's former chief, was going to be present, the seconding of this motion could better have been undertaken by him. They all looked forward to another most successful year under the new President.

Mr. DANIEL IRVING supported the motion, which was carried with acclamation.

Mr. R. ROBERTSON (Bristol), returning thanks for his election, said he felt it a great honour to be chosen as the President of what was the largest, one of the oldest, and certainly one of the most virile of the District Associations, with a record of work of which anyone might well be proud. He felt, in saying this, that that record need not be closed, because they had by no means reached finality in the work which Associations such as theirs were able to do. Knowing as he did the latent capacity their Association had, both individually and collectively, for carrying on such work, he felt every confidence in the future; and it was a good augury for the industry that what applied to the Southern Association applied equally to other similar organizations throughout the country. The spirit of inquiry and experiment which animated the Gas Associations was infinitely better than any subsidy that any Government could give. He undertook with a considerable amount of diffidence and with some feeling of dismay to follow in the line of succession of the distinguished engineers who had filled the office of President. He had a difficult example to follow, for Mr. Moon had set a very high standard indeed. However, there was a capable Hon. Secretary and an efficient Committee, who would see that the interests of the Association did not suffer during his year of office. [Laughter.]

THE VICE-PRESIDENT.

Mr. ROBERTSON said he thought the Committee had been exceptionally fortunate in securing for nomination as Vice-President a gentleman they all knew and esteemed—Mr. Thomas Hardie, the Chief Engineer of the Gas Light and Coke Company. He had great pleasure in proposing his election.

Mr. C. VALON BENNETT (Rochester) seconded the motion, which was cordially passed.

The PRESIDENT said he was sorry that Mr. Hardie had notified his inability to be present at the meeting. He had hoped to be with them, but at the last moment had been detained.

GENERAL COMMITTEE AND DISTRICT COMMITTEES.

The HON. SECRETARY (Mr. H. C. Smith, of Tottenham) read out the following list of elections of district officers and members of committees for 1926:

Eastern District, 1926.

Chairman.—Mr. J. Terrace.
Vice-Chairman.—Mr. C. Valon Bennett.
Hon. Secretary.—Mr. L. Trewby.
Committee.—Messrs. A. H. Andrews, W. H. Bennett, A. Caddick, T. Carmichael, G. M. Gill, L. G. Humphrys, S. Lacey, L. J. Langford, C. T. Price, R. H. Ruthven, C. H. Rutter, F. Smallbone, A. W. Sumner, J. S. Thorman, and W. H. Warren.

Representatives on the General Committee in place of those retiring by rotation: Messrs. C. H. Rutter and F. Smallbone.

Western District, 1926.

Chairman.—Mr. C. G. Dawson.
Vice-Chairman.—Mr. J. Hughes Cornish.
Hon. Secretary.—Mr. J. B. Cattle.
Committee.—Messrs. J. Armstrong, W. E. Dean, S. E. Halliwell, H. Higham, P. S. Hoyte, J. Harger Pye, H. E. Riley, J. Taylor, W. P. Tervet, E. P. Vince, and J. Wesley Whimster.

Representative on the General Committee in place of member retiring by rotation: Mr. J. Wesley Whimster.

HON. AUDITORS AND HON. SECRETARY.

On the proposition of Mr. A. E. BROADBERRY (Buckhurst Hill), seconded by Mr. W. PHILLIPS (Luton), Messrs. James Donaldson and John Urquhart were re-elected Hon. Auditors.

The PRESIDENT said he did not think he was breaking any confidence in telling them that, in accordance with established custom, their Secretary had resigned, and, also in accordance with established custom, the Committee had refused to accept that resignation. So honour was satisfied. [Laughter.] He had great pleasure in proposing that Mr. Smith be re-elected for the ensuing year as their Hon. Secretary. He performed the many duties of the office excellently.

Mr. J. TERRACE (Lower Sydenham) seconded the proposal; and it was unanimously carried.

Mr. SMITH, in acknowledgment, remarked that the office was one which combined work and pleasure.

MR. T. H. MARTIN AN HONORARY MEMBER.

The PRESIDENT said that, as all were aware, they were that day celebrating the jubilee of the Association, and Mr. T. H. Martin was the sole surviving founder member. The only honour it was in the power of the Association to bestow was that of honorary membership; and this they would all be proud to confer upon Mr. Martin. It was the least they could do; and the only matter for regret was that his medical adviser would not allow Mr. Martin to be with them that day. He proposed that Mr. Martin be elected an honorary member of the Association.

Mr. W. E. PRICE (West Chobham) said he had been asked to second this as being, in period of membership, the oldest present. Mr. Martin was at the preliminary meeting, which was held at the house of the then Manager of the Richmond Gas Company, Mr. J. Eldridge; and he was the only one of those then present who was still living. Mr. Martin was an old friend of his, in times when things were a little rougher than to-day, and when there were perhaps more pitfalls, and to some extent took him (the Speaker) under his wing. He therefore entertained very kindly feelings for him.

Mr. C. F. BOTLEY (Hastings) said Mr. Martin was a resident of Hastings, where he had seen him within the last few days. He was able to get about; but being over 80 years of age, it would have been a big undertaking for him to come to the meeting. He did, however, appreciate very much the fact that he was to be elected an honorary member. His (Mr. Botley's) own father was one of the earliest members of the Association, having been elected at the first annual meeting.

The motion having been heartily passed by the meeting,

The PRESIDENT asked the Hon. Secretary to inform Mr. Martin of his election, and of the best wishes of the members for his continued well-being.

NEW ORDINARY MEMBERS.

The HON. SECRETARY then read the following names of new ordinary members who were elected:

Mr. Robert Streeter Falkner, Sandown.
Mr. John Henry Lowther, Bideford.
Mr. Frank Ernest Stocker, Highbridge.

PRESENTATION OF CERTIFICATES.

The PRESIDENT said they now came to a little ceremony which he had been asked to perform by the Institution of Gas Engineers. The Higher Grade Examination in gas engineering held by the Institution had resulted in the awarding of certificates to four candidates who were in the Association's territorial area; and the Institution had expressed the wish that the certificates should be formally presented at the Association meeting. This, of course, they were only too glad to do. If the Association and the industry were to go ahead, they must have new blood, new ideas, and virile brains; and the only way in which they could secure them was by encouraging the young men to equip themselves properly for playing their part. The certificates he had to present to the following successful can-

didates were tangible evidence that at any rate certain young men were so equipping themselves :

Mr. Neville V. Clarke. Mr. John Farmer.
Mr. Bernard Dawkins. Mr. William Storey.

The New Gas-Works at Pitwines, Poole.

The PRESIDENT remarked that the next item on the agenda was the discussion of the paper which he read at the annual general meeting in March last on "The New Gas-Works at Pitwines, Poole," of the Bournemouth Gas and Water Company. [See "JOURNAL" for April 8, p. 117.] It was a matter of regret to him that the discussion had had to be postponed, because the general experience was that, when a certain time had elapsed since the reading of a paper, the discussion was apt to suffer. However, they had insisted upon the item being placed on the agenda.

Discussion.

Mr. J. TERRACE (Lower Sydenham) remarked that, as one of those who took perhaps a somewhat active part in preventing the President's valuable paper being pushed on one side after very scant discussion at the last meeting, he might claim the privilege of opening-up the matter again now, though, as the President had suggested, it was a somewhat difficult thing to do so long a time after the reading of the paper. It did not fall to the lot of every company to enjoy an increase of business at the rapid rate experienced at Bournemouth—he thought the Bournemouth Company had doubled their gas sales twice in twenty years. Nor, therefore, did it fall to the lot of every engineer to carry out the erection of plant to meet such rapidly growing requirements. The President towards the end of his paper paid very handsome tribute to all those who had helped him, and to his Directors for having allowed him to go on with his scheme; and he was sure they, as brother engineers, would wish to pay a tribute to Mr. Moon for the very valuable work he had done, and to congratulate the Company on having in their service a man who was capable of such work. Mr. Moon's paper was by an engineer, on an engineering subject, for engineers; and as such they all thoroughly appreciated it. His engineering skill was shown by the way in which he had handled the problem and carried out the work. In the matter of the safe load which might be trusted to piles, the President showed the difficulties that might be encountered by taking knowledge from text-books, rather than by relying upon good engineering common-sense; and they also found evidence of his engineering ability again in the fact that he was not afraid on one occasion, when he found certain tanks had been placed in unsuitable ground, to have them transferred to new foundations. The difficulties of the site at Pitwines were very great indeed; and for an engineer to carry out work on such a site and not to expect to come up against one or two "snags" would be too much. The story of the arrangement of the works and how the whole job was carried out made most interesting reading. If the paper had a fault at all, it was that in one or two places some of them might have looked for more information; but, of course, the author had been faced with the difficulty of getting a large amount of matter into a comparatively small space. Really a paper like that was far more useful for reference than for discussion; but there were just one or two things he would like to ask.

THE "ARCA" REGULATOR.

Mr. Moon mentioned the "Arca" regulator, and though most of them knew what this regulator was, it would be interesting to know the author's views regarding it, as opposed to the ordinary method of vacuum governors for regulating the pull on the retorts. As to the suction producers which supplied the gas for the gas engine dynamo plant, it would add to the value of the paper if they could have some further information—whether these producers were satisfactory or not. Generally they had to rely on text-books or the catalogues of the makers for figures as to quantity of fuel used per horse power, &c.; but it would be very much better to have them from an actual user. His next point was as to ammonia extraction. It would be remembered that Mr. Moon put his gas through a Livesey washer and an ordinary scrubber, and then passed it through a weak acid solution to remove the last traces. Had he found that there was any trouble in purification through the gas being acid? Most of them had been brought up in the belief that it was wise to have their gas slightly alkaline at the inlet to the purifiers. The idea of bringing all the machinery together under one roof was an excellent one; and he hoped the point had been widely noted. The saving obtained by adopting such a course was enormous. Really in constructional work the capital cost was only a very small consideration; it was the running costs that counted, and the gain in this respect by having all the machinery together could not be doubted.

Mr. R. ROBERTSON (Bristol) agreed with Mr. Terrace that it would have been a very great pity to put the paper on one side without proper discussion. Many of them had had the benefit since the reading of the paper of actually seeing the plant, and had been greatly impressed with the design and carrying out of the work. He also would like further enlightenment on one or two points. Mr. Terrace had already referred to the "Arca" regulator. Had the author made any provision for overcoming what he (the speaker) thought was a defect of this system—that it depended on a constant stream of water? Then the author screened his coke from the top of the hopper; whereas it seemed to him (the speaker) that the proper place was at the bottom of the hopper. What determined Mr. Moon's selection in this matter? Obviously there was a certain amount of breakage after the coke had left the screen, if it was screened at the top; and this went forward to the consumer in the form of breeze or broken coke.

THE STEAM SUPPLY.

Another point was the steam supply. It seemed there were four sources of supply—waste-heat boilers on the verticals and the carburetted water gas plant, two Stirling boilers, and a jacket boiler on the water gas plant. Were all these systems connected-up, and, if so, in what way did he accommodate the varying pressures? He understood the jacket boiler pressure was only 25 lbs., whereas the waste-heat boilers would be probably 100 lbs. or over. In this connection it seemed to him that the system called for rather more reserve than a tubular boiler was calculated to give. Would not a Lancashire boiler in place of the Stirling boiler have afforded a more reliable reserve? Had the author any figures relating to the thermal efficiency of the jacket boiler method of generating steam? The heat was obtained at the expense of the heat of the charge in the generator, and this must have some effect on the ultimate thermal efficiency of the plant. Was there any saving in labour as an offset to the outlay on the automatic chargers for the water gas sets? In the lay-out the author had provided for steaming verticals; and this would give a certain amount of control over the quality of the gas. In addition, he had provided a carburetted water gas plant. How could these things be reconciled? It seemed rather difficult to combine the two systems, by making the best use of the steaming of the verticals and at the same time utilizing the water gas plant, without an undue consumption of oil, which at times might be rather inconvenient.

AUTOMATIC WATER GAS SETS.

Mr. PERCY S. HOYTE (Plymouth) remarked that many of the points raised by previous speakers had been in his own mind. The paper would prove of the utmost value to those of them who in the future might be called upon to deal with a site of such—if he might so call it—an appalling nature as that on which Mr. Moon had erected these magnificent works at Pitwines. They would find in it sound practical information as to the use of piling. The paper proved that text-books did not give one precisely the data that might be required. With regard to the carburetted water gas plant, he had been particularly interested in this, because the author appeared only to have equipped his plant with an automatic charger. He would like to know whether he had any reason for not completely equipping this plant so as to make it automatic throughout. Such plants were in use in this country; and they had had one in operation for two or three months at Plymouth. It had not yet gone through its official tests; but he had for a couple of months been working on a complete cycle of 3 minutes—40 p.ct. devoted to blast, and the remaining 60 p.ct. to up-run, down-run, and up-run. It was a cycle perfectly impossible to accomplish by hand. It was completely automatic; and as far as they had gone, they had nearly doubled the output of this plant with automatic working—of course, with larger accessory apparatus. Formerly they were making 1½ million c.ft., and had already under the altered conditions exceeded 2¼ millions; and he believed they would reach very nearly 2½ millions when they got the plant thoroughly tuned up. In connection with the sulphate plant, Mr. Moon had made provision for using either lime or soda ash. Which of the two did he prefer? There was little profit left in the manufacture of sulphate of ammonia nowadays; and as was rightly admitted in the paper, soda ash was more expensive to use than lime. It was quite possible that its use might reduce very substantially the already small profit. Altogether the paper provided a model of how a works should be laid out.

ON THE CHEMICAL SIDE.

Dr. T. LEWIS BAILEY (Chief Inspector of Alkali, &c., Works) said there were one or two points that had struck him, entirely on the chemical side, about which the author might perhaps give them a little more information. He thought the weak liquor from the retort house went to the rotary washer. This weak liquor was presumably produced in a long main. Could Mr. Moon give them the approximate length of this main, and at the same time the composition of the liquor which was condensed in it, as regards free and fixed ammonia? The next point was in regard to the water tube condensers. The inlet gas temperature was 140° Fahr., and the outlet gas temperature of the second one was 60° Fahr.—that was to say, the gas went in there at a fairly high temperature. Could Mr. Moon tell them the strength or composition of the liquor produced in each condenser? He imagined the liquor produced in the first condenser would be relatively weak; and this led him to wonder whether, instead of, as he presumed he did, running the two direct to the well, it would not be better to run the first liquor (if it was as weak as he thought) to the washer, and so increase its strength before it went to the well. Had Mr. Moon any information as to the relative quantities of weak liquor produced in the retort house and of liquor produced in the condensers? These struck him as points which might well be considered. Perhaps it might be possible to alter slightly the conditions if all the facts were known. He anticipated that in the retort house there would be a high proportion of fixed ammonia; and this set him on another track, which was to wonder whether it might not be better to introduce more rapid condensation at the beginning, with a view to getting out as much tar as possible before starting the condensation of liquor at all. Did the author find it necessary to by-pass ammonia to his purifiers? He presumed he did.

CLAY AND CAST-IRON MAIN CORROSION.

Mr. R. H. RUTHVEN (Ramsgate) said the President surrounded his mains with clay for protection against corrosion. It should not be necessarily assumed that clay would protect cast iron against corrosion; for some clays had a very serious effect on cast irons from this point of view. There were cases in which one had in time mere graphite, which could be dug away with a penknife. Some years ago a paper on the subject was read before the Institution of Water Engineers.

RUBBER BELTS.

Mr. L. J. LANGFORD (Tunbridge Wells) remarked that a good many of them were much interested in the transport of coal and coke. The President was using rubber belts for both coal and coke; and it would be of value to have his opinion as to the life of a rubber belt transporting coke, as compared with coal.

THE PRESIDENT REPLIES TO QUESTIONS.

Mr. MOON said he highly appreciated the kind references that had been made by the different speakers to the paper he had been privileged to read—because he did regard it as a privilege to read a paper before the Association. They had treated him very nicely, and they had also given him a number of questions to answer. Mr. Terrace asked about the "Arca" regulators. They had had experience with the ordinary vacuum governor, and had found that, if they got them as close to the retorts as they felt was desirable, there was usually a certain amount of trouble with regard to gumming-up of the valves, and consequently some uncertainty of action. Therefore they had themselves substituted for these vacuum governors a butterfly valve arrangement which was hand-adjusted; and in spite of the fact that it was hand-adjusted, the regularity of output of gas from the vertical bench was such that they could usually get better results than with the automatic vacuum governor. Then the "Arca" regulator was introduced to his notice; and he found it was an automatic arrangement for adjusting a butterfly valve. From the experience which others had had of it, it seemed to be a fairly reliable apparatus. The construction was good; and they had decided to adopt it. He could not tell them anything about the way in which it worked, because, as he had explained in the paper, they were just completing the works. As a matter of fact, they had not yet started gas making, but were hoping to do so within a fortnight. Therefore, how their anticipations would work out in practice remained to be seen. But at the moment he could not see that there was very much room for trouble, except (and that did not seem likely) on account of the water supply. There ought to be no difficulty in assuring that.

With regard to producer plants for gas engines, he had given in the paper the reasons that had led him to suggest the use of these instead of town gas. There had been a certain amount of criticism; but he still felt they were not in any way endangering the sale of town gas for engines by the fact that they, with a 24-hour load, themselves used producer gas for engines. He did not think that anything was gained by failing to face facts; and if they had to advise a manufacturer who had a 24-hour load, all things being equal, they could not, to his mind, justify the installation of engines run on town gas. With regard to figures, the guarantee was 1·4 lbs. of coke per brake horse power; and this was quite easily maintained over a works test. Taking town gas at 2s. per 1000 c.ft., coke at 25s. a ton, and anthracite at 35s., the relative costs for fuel for generating 1 KW. of electricity worked out at 0·71d. for town gas, 0·246d. for anthracite, and 0·24d. for coke. Thus there was a big margin, which in his opinion justified the use of producer gas.

Mr. HOYTE: That is for a 24-hour plant.

Mr. MOON said the whole point lay in the fact that they had a reasonably high load factor over the whole 24-hour day. In the case of an 8-hour load very different conditions would prevail.

A question had been asked as to acid washing. It was quite true that, washing gas with a weak solution of acid, one did, unless other precautions were taken, pass a neutral gas—not an acid gas—and at his works they had now as a regular thing between the inlet and the outlet of the acid washer a ⅜-in. pipe with a regulating valve, so that a small stream of gas containing ammonia could pass to the outlet of the acid washer. As a matter of fact, they had adopted also one other precaution which had been found very useful. In spite of all they did—and even before they adopted acid washing—there was a tendency for sulphate to become acid. Of course, his Company had water works as well as gas works; and at one of the water pumping stations there was a softening plant, one of the by-products of which was precipitated carbonate of lime in very finely divided form. A certain amount of this lime was mixed with the purifying material, so that as soon as this acid tendency developed it reacted upon the calcium carbonate, and maintained the purifying material in at least a neutral condition.

As to why they did not screen coke at the bottom of the hopper instead of the top, he had merely continued what had always been the practice with his Company. He knew there were two schools of thought on the subject; but in this particular installation they had eliminated as far as possible the obvious disadvantages of top screening by having a portable screen, so that the coke could always fall without a long drop. This largely did away with any tendency to form breeze. They loaded the coke from the graded hoppers direct to the consumers; and the fact that they never had any surplus coke to sell (but were usually buying somebody else's from outside, so as to retain their market) showed that they were not suffering injury by screening at the top of the hopper.

He was not surprised that the question of steam provision had been raised. There were, of course, waste-heat boilers both on the vertical retorts and on the water-gas plant. With the Pitwines Works making sulphate, as they proposed to do for the whole of the works of the Company, they would have a demand for steam which could not be supplied, much as they would like to supply it, entirely from waste heat. Therefore they had had to introduce other units, in the form of Stirling tubular boilers, which were selected largely because of the facilities offered for mechanically burning breeze on the moving grate. At the Poole Works they had had a long experience of these tubular boilers with mechanically-operated grates, and obtained very good results from them. Such experience it would have been unwise to disregard. It was true that the steam pressure of the water jacket of the generator was only 25 lbs.; but all of it was used, and a little more was required, for the actual generator. So there was no question of having to adapt this low-pressure steam to other parts of the works. It was obvious that they could not maintain this water jacket and generate steam without burning extra fuel in the generator; but if they were doing this, they were not consuming it to produce steam somewhere else. There were contingent advantages attached to the use of a water jacket for the generator, which left a balance in its favour.

The possibility of having an entirely automatic water gas set was, as could be imagined, very fascinating; and the matter received careful consideration; but it was felt that with one unit only of water gas plant on the works the time had hardly come for making it completely automatic. Since he had had more information with regard to the contingent advantages of the all-automatic set, he regretted that it had not been adopted, but he hoped that it would be in the not too distant future. The hydraulic charger and the self-clinkering generator, of course, effected considerable savings in labour. In fact, the whole of this unit was worked entirely by one man. The installation of carburetted water gas plant as well as verticals which were steamed was perhaps rather difficult to explain. When steaming verticals, one got a very definite advantage; but it did reduce the illuminating power, although the balance in therms was very much on the right side. But this could only be done if they had other means of maintaining the statutory calorific value; and the whole question of water gas as compared with coal gas depended upon two factors. One was the coke market, and the other was the price of oil. He quite agreed that from time to time it was necessary to determine which process would pay best, bearing market conditions in mind. With only a blue gas plant available much freedom of action in this respect would be lost.

He had been asked which he would prefer to use, lime or soda ash, in his sulphate of ammonia plant; and his answer was "Soda." Had he been asked which he now used, his reply would have been "Lime." They had given soda a long trial. It had many advantages; but on the balance-sheet at the present moment certainly it did not pay, and they had reverted to lime. But the plant would use either. In answer to the remarks of Dr. Bailey, he regretted that, the works not yet being in operation, he could not give the figures desired, though he fully realized the valuable character of the suggestions behind these questions. They had kept the length of the foul main down to the minimum. The gas was taken off in the centre, and the liquor had a minimum run. From experience with a somewhat similar installation at the old works, he could say that the foul main liquor did contain largely fixed ammonia and a minimum quantity of free ammonia. Also, the first condenser did produce a lower Twaddell ammonia than the second condenser; but, even so, with steaming the verticals, the second condenser liquor was none too high in Twaddell. Therefore the whole of it had to be circulated through the scrubbers and the Livesey washer, so as to take up strength. They mixed the whole of the virgin liquor—everything up to the outlet of the condensers—and re-circulated it. No water was added at any point. Dr. Bailey's questions certainly pointed out a direction in which investigation could usefully be made. Perhaps others had gone closely into the character and composition of the ammoniacal liquors at different points throughout the works.

He had been rather concerned to hear Mr. Ruthven's remarks; and he was glad to think that, in addition to coating the mains with clay, he had covered them with chalk residue from the water works. He hoped, if the clay failed them, this would help to put matters right. With regard to Mr. Langford's inquiry, he had up to now had experience with rubber belts only for coal; but they were being used to an enormous extent for coke in the United States, and there was no doubt that, given reasonable conditions of depositing the material on, and removing it from, the belts, the latter would have a long life. In America they were even used for coke containing a certain amount of heat.

AMERICAN GAS PRACTICE.

Mr. G. M. GILL then read a paper entitled "Some Notes on American Gas Practice," which was illustrated by a large number of first-rate lantern slides, showing plant which the author had inspected during visits to the United States. The paper and discussion will be found on p. 512 of this issue.

On the proposition of the PRESIDENT, the author was heartily thanked.

THE PRESIDENT THANKED.

Mr. L. J. LANGFORD (Tunbridge Wells) said that as this was the last occasion on which they would see Mr. Moon in the chair, he would like to propose a hearty vote of thanks to him for the very able manner in which he had presided over the Association, and for the assistance and guidance he had given them during his year of office. They owed him a great deal, too, for his able address and the paper on the Pitwines Works, and then there was the pleasant summer meeting at Bournemouth, and the kind reception given them by the President and by his Chairman and Directors. ["Hear, hear."] The works they saw there were a monument to Mr. Moon's skill as an engineer, as well as (having regard to the site) to his pluck, perseverance, and energy.

Mr. W. H. WARREN (London) seconded the vote, which was carried with acclamation.

The PRESIDENT returned thanks, declaring that his year of office had been a happy one so far as he was concerned, because he had felt all through that he had the sympathy and support of both officers and members of the Association. The unduly critical spirit had been entirely absent. Every effort had been directed to the best interests of the Association; and this was the right way to go on.

Will.—Mr. Hubert Dynes Ellis, J.P., who died on Oct. 14, left estate of the gross value of £54,196, with net personalty £51,092.

"S.B.G.I." Golf Club.—At the autumn meeting of the Society of British Gas Industries Golf Club, which took place at Moor Park on the 11th inst., Mr. H. A. Martin, of Lighting Trades, Ltd., won the Thornton Cup.

JUBILEE OF THE SOUTHERN ASSOCIATION.

FOUNDED ON JULY 15, 1875.

ADVANTAGE was taken of the business meeting of the Southern Association of Gas Engineers and Managers to celebrate the attaining of the jubilee of the Association by a dinner in the evening at the Hotel Cecil; and in connection therewith a charming little souvenir book was prepared, from which the following is taken.

The Association was founded in the year 1875 as "The Southern District Association of Gas Engineers and Managers." A preliminary meeting of gentlemen favourable to the formation of the Association was held at the Richmond Gas-Works on Thursday, July 15, 1875, the following being present: Messrs. Eldridge, Farrand, Packham, Scott, Martin, Wadeson, and Chapman. Mr. Eldridge having been voted to the chair, Mr. Chapman was requested to undertake the duties of Secretary, *pro tem.*

Mr. Scott proposed: "That an Association be formed, to be called 'The Southern District Association of Gas Engineers and Managers.'" Mr. Farrand seconded the motion, which was carried unanimously. It was then moved by Mr. Packham, and seconded by Mr. Wadeson: "That Messrs. Eldridge, Martin, and Chapman form a Sub-Committee to draw-up regulations for the management of the same." This resolution was likewise adopted, and the meeting was adjourned.

The second preliminary meeting was held at the Richmond Gas-Works on Thursday, Sept. 16, 1875—Mr. Eldridge in the chair.

OBJECTS OF THE ASSOCIATION.

The minutes of the previous meeting having been read and agreed to, regulations were submitted by the Committee appointed for the purpose. The first of these regulations dealt with the purpose for which the Association was formed, and was to the effect that: "The Association shall be for the purpose of more frequent intercourse among gas engineers and managers connected with the Southern Counties, on all matters of gas engineering and manufacture, than is at present available." The regulations numbered 21; and it is interesting to note that among them no mention was made as to the qualifications necessary for membership. At this meeting, after some discussion, the regulations were agreed to.

The following gentlemen expressed their willingness to become members of the Association:

Broadberry, W. H. H., Tottenham.	Parlby, W., Aylesbury.
Chapman, J. L., Harrow.	Phillips, A. F., St. Albans.
Eldridge, J., Richmond.	Price, E., Hampton Wick.
Farrand, C., Croydon.	Scott, G., Tunbridge Wells.
Martin, T. H., Barnet.	Wadeson, J., Windsor.
May, T., Canterbury.	West, J., Maidstone.
Packham, H F., Kingston.	Wood, A. H., Hastings.

Mr. Price proposed, and Mr. Martin seconded: "That Mr. Alfred H. Wood be the President of the Association for the year 1876," which was unanimously carried. On the motion of Mr. Price, seconded by Mr. Scott, Mr. Eldridge was appointed Treasurer. Mr. Packham then moved that Mr. J. L. Chapman be appointed Honorary Secretary, which was seconded by Mr. Parlby and adopted. The following gentlemen were elected to act as a Committee of Management until the second Thursday in February, 1876: Messrs. Packham, Parlby, Scott, Price, Broadberry, and Martin.

FIRST ANNUAL MEETING.

The first annual meeting of the Association was held at the Bedford Hotel, Southampton Row, London, on Thursday, Nov. 11, 1875, when the following new members were elected:

Botley, C. E., W. London Junction.	Farrand, F., Jun., Acton.
Brett, R. W., Hertford.	Mitchell, H. J., Hornsey.

The President (Mr. A. H. Wood, of Hastings) then delivered his inaugural address, at the conclusion of which a vote of thanks for the same was proposed by Mr. Eldridge, who described the address as being not only a very practical one, but also as embodying the exact views the promoters had in forming the Association.

Mr. Parlby, in seconding the motion, said the question of the difficulties attending the lighting of public lamps, and also of leakage, had been very clearly dealt with, and he hoped the address would be printed in the "JOURNAL OF GAS LIGHTING." (This was done, and the address was also printed separately and distributed among the members.)

The resolution having been carried, the meeting separated.

The foregoing account of the formation of the Southern District Association of Gas Engineers and Managers in the year 1875 has been extracted from the first "Transactions" of the Association.

Of the Founders of the Association, the only surviving member is Mr. T. H. Martin, who is now the Chairman of the Harpenden Company.

From the efforts of those far-seeing Gas Engineers of fifty years ago has resulted the Southern Association of Gas Engineers and Managers as we know it, with its 306 members.

PRESIDENTS AND HONORARY SECRETARIES, 1875-1925.

Year.	President.	Secretary.
1875	A. H. Wood, Hastings.	J. L. Chapman, Harrow.
1876	Do.	Do.
1877	Do.	Do.
1878	J. Eldridge, Richmond.	Do.
1879	J. West, Maidstone.	Do.
1880	J. Hunter, Woolwich.	Do.
1881	W. H. Broadberry, Tottenham.	Do.
1882	C. Gandon, Sydenham.	Do.
1883	W. A. Valon, Ramsgate.	Do.
1884	D. F. Goddard, Ipswich.	Do.
1885	C. E. Botley, Wormwood Scrubs.	Do.
1886	G. Livesey, South Metropolitan.	Do.
1887	W. D. Child, Romford.	Do.
1888	J. L. Chapman, Harrow.	J. W Helps, Croydon.
1889	J. Somerville, South Metropolitan.	Do.
1890	T. May, Richmond.	Do.
1891	J. Methven, Nine Elms.	Do.
1892	A. Dougall, Tunbridge Wells.	Do.
1893	C. C. Carpenter, South Metropolitan.	Do.
1894	H. Smythe, Maidstone.	Do.
1895	S. W. Durkin, Southampton.	Do.
1896	A. F. Browne, South Metropolitan.	Do.
1897	J. W. Helps, Croydon.	D. H. Helps, Croydon.
1898	R. Beynon, Torquay.	J. W. Helps, Croydon.
1899	A. E. Broadberry, Tottenham.	Do.
1900	D. Irving, Bristol.	Do.
1901	Corbet W. Woodall, London.	Do.
1902	W. E. Price, Hampton Wick.	Do.
1903	J. Tysoe, South Metropolitan.	Do.
1904	D. H. Helps, Reading.	Do.
1905	S. Carpenter, Dorking.	Do.
1906	F. W. Cross, Lea Bridge.	A. F. Browne, South Met.
1907	H. W. Woodall, Bournemouth.	Do.
1908	N. H. Humphrys, Salisbury.	Do.
1909	J. Paterson, Redhill.	Do.
1910	C. S. Ellery, Bath.	W. E. Price, Hampton Wick.
1911	H. C. Head, Winchester.	Do.
1912	B. R. Green, Mitcham.	Do.
1913	H. O. Carr, Wandsworth.	Do.
1914	Thomas Glover, Norwich.	H. C. Head, Winchester.
1915	J. W. Auchterlonie, Cambridge.	Do.
1916	W. Doig Gibb, London.	Do.
1917	W. N. Westlake, Exeter.	Do.
1918	W. B. Farquhar, Ilford.	Do.
1919	Frank Livesey, Maidstone.	Do.
1920	C. F. Botley, Hastings.	W. H. Bennett, Redhill.
1921	J. Wesley Whimster, Bath.	Do.
1922	J. M. Campbell, Margate.	Do.
1923	P. S. Hoyte, Plymouth.	Do.
1924	L. J. Langford, Tunbridge Wells.	Do.
1925	P. G. G. Moon, Bournemouth.	H. C. Smith, Tottenham.

MESSAGES OF CONGRATULATION.

D. Milne Watson, D.L.,

President of the National Gas Council.

I have much pleasure in sending a short message of congratulation to the Southern Association of Gas Engineers and Managers on the occasion of its jubilee celebrations.

I am interested to note that the Richmond Gas-Works, which will soon be taken over by the Gas Light and Coke Company, was the scene of the Association's birth; and it gives me great pleasure to see among the names of the Past-Presidents those of the late Sir Corbet Woodall and Sir Daniel Goddard, both of whom, in their time, rendered yeoman service to the Gas Light and Coke Company.

Few industries are more dependent on the scientific attainments of engineers and managers than the gas industry; and nothing so tends to broaden the minds and increase the experience of such men as the facilities for regular conference provided by your Association.

With every good wish for the success, prosperity, and long life of the Southern Association of Gas Engineers and Managers.

C. F. Botley, M.Inst.C.E.,

President of the Institution of Gas Engineers.

It affords me, as President of the Institution of Gas Engineers, especial pleasure to congratulate the Southern Association on the attainment of its jubilee.

Naturally, it is a time of retrospection; and what memories can be recalled of honoured names in the gas industry and of many friends who have "passed on," having, in their day, contributed to the success and usefulness of the Association! As a District Association affiliated to the Institution, the Southern, with its record of service to its individual members and to the whole industry, quite properly claims a high place; and it is only necessary to remember several papers which have been contributed by members in recent years. Surely, such a record must at this time of jubilee serve as a great inspiration to present and future members to maintain, and, so far as may be, enhance the reputation of the Southern Association.

T. H. Martin, A.M.Inst.C.E.,

Founder Member 1875; elected Honorary Member 1925.

I remember Mr. James Chapman coming to see me at Barnet to talk over the question of the formation of an Association of Gas

Engineers, with the result that a meeting was held at the Richmond Gas-Works on July 15, 1875, which led to the formation of the Association.

It is very pleasing to find the Association in such a splendid condition after fifty years, and doing such useful work.

Charles C. Carpenter, C.B.E., D.Sc., M.Inst.C.E., M.Inst.M.E.,

Elected 1886.

I beg to offer my hearty congratulations to the President and Council of the Southern Association of Gas Engineers and Managers on the attainment of its jubilee.

Founded with the primary object of giving consideration to, and of discussing problems associated with, the manufacture and distribution of gas, it has, in this connection, supplemented by an enormous amount of useful work the duties of the parent Institution.

To have existed for fifty years is, in itself, a complete justification of the hopes and expectations of its founders. If during that time the developments in the manufacture and distribution of gas, and a consideration of their concomitant problems, have shown the need for such an Association—and this they certainly have—then the new era upon which it, with the gas industry, is now entering must more than ever test its vigour and vitality in coping with the increasing number of problems—technical, commercial, administrative, and economic—with which the industry is faced.

Henry Woodall, M.Inst.C.E.,

Elected 1901.

The Association has had in its ranks a great number of the most distinguished gas engineers, and has a history of fifty years of which it may well be proud.

Old traditions are an encouragement and an incentive. The Association grows steadily in numbers and quality; so we can look forward to continued usefulness, the promotion of good fellowship, and the generous exchange of ideas and experience which has always been such a notable feature with us.

Sir Arthur Duckham, K.C.B., M.Inst.C.E.,

Elected Ordinary Member 1906; *elected Honorary Member* 1920.

Heartiest congratulations on the achievement of your jubilee. Gas is more of a live issue and a national necessity than ever. The ever-increasing keenness of all concerned points the way to continued success.

JUBILEE DINNER.

In the evening a large number of members and guests sat down to dinner in the Hotel Cecil, to celebrate the jubilee of the Association; and a happy celebration it proved. Thoughts went back to the past, and forward to the future; while it was felt by all (for that evening at any rate) that the present was well able to take care of itself. A spirit of optimism was manifest throughout the proceedings; and the speeches (of which, unfortunately, space permits only a summary to be given here) proved the gas industry's title to high place in the realm of humour. Mr. Moon, as President, was in the chair; and there were with him at the top table Mr. D. Milne Watson, D.L., Dr. Charles Carpenter, C.B.E., Mr. Henry Woodall, Mr. C. F. Botley, Mr. R. Robertson, Dr. T. Lewis Bailey, Lieut.-Col. H. W. Woodall, C.I.E., Mr. E. H. Swain, Mr. L. J. Langford, Mr. F. Napier Sutton, Mr. Walter T. Dunn, and Mr. H. C. Smith.

REGRETS AND CONGRATULATIONS.

The PRESIDENT, having submitted the Loyal Toast, went on to express regret that Sir Arthur Duckham, K.C.B., had been prevented by indisposition from being with them that evening. He had, however, sent the following message: "Please convey to the members of the Southern Association my heartiest congratulations and best wishes; also my deep regret at not being present." Then there was still living one founder member, Mr. T. H. Martin, who had hoped to join them, but had been advised by his doctor not to venture out in the evening. He had written expressing the hope that they would have a bright and successful meeting. Mr. T. Hardie had also written regretting his inability to be present, and offering congratulations and best wishes. Communications to a like effect had been received from Mr. J. Paterson, of Cheltenham, Mr. T. Glover, of Norwich, and many others. Further, there had been congratulatory messages and best wishes from the Presidents of all the other District Associations.

THE ASSOCIATION.

Lieut.-Col. H. W. WOODALL, in the absence of Sir Arthur Duckham, who was to have submitted it, proposed the toast of "The Southern Association of Gas Engineers and Managers." He said the existence of these organizations was essential to the welfare of the industry, inasmuch as the conditions were such that one Institution, however efficient, could not possibly carry out the whole of the work. The Southern Association were justly proud of what they had accomplished in the past, and were looking hopefully to the future. Looking round, one recalled many happy occasions, and a few sad ones, when a familiar face was missed. They were fortunate in their industry and in the men who controlled it. When the "giants" who had worked so hard for the industry in the old days passed away, some of them were a little anxious as to what would happen to the industry; but it had been found that, great as were these people of the past, others equally great in their way had come along to help in the good work. The very growth of the industry today made it impossible for individual engineers to carry on by themselves; it was only by the united efforts of a united industry that they could hope to make the best possible progress. The Southern Association had always borne their full share of united effort, and he was sure would continue to do so. ["Hear, hear."] Probably there never was a time when the gas industry had anything like the competition to face that existed to-day; and it was only by gas engineers proceeding along the most scientific lines of manufacture and distribution that they could hope to improve upon, or even maintain, the position they now held. To endeavour to "maintain" a position was no good to anybody. Directly one ceased to progress, it would be found that movement the other way began. But to struggle was the essence of life, and competition was the spur to progress; and he felt quite sure that, while Associations such as this continued to flourish, there would be no lack of forward movement. The coming years, he had no doubt, would be more prosperous, and better worth working for, than anything the industry had experienced in the past.

A GREAT PUBLIC SERVICE.

The PRESIDENT, in acknowledgment, remarked that Lieut.-Col. Woodall had been called upon at the last moment, and the way in which he had acquitted himself provided one more example of the ability of gas engineers to rise to the occasion. While, of course, deeply regretting Sir Arthur Duckham's absence, it was peculiarly pleasing to him that he should have to reply to the toast of the Association proposed by his old Chief and present Director, to whom he owed more than he could ever hope to repay. The proposer had very rightly referred to the work that had been done by their predecessors; for it was fitting that this should be the first note on such an occasion as they were celebrating. Their predecessors had borne the heat and burden of the day. They had had to face difficulties and try to solve problems at a time when trained assistance was all too scarce; and they had built firmly and well the foundations upon which their great industry had been raised. All honour to them! It was up to those who were at present connected with the industry to walk worthily in the footsteps of these predecessors; they had to carry on the torch. They had to look forward as well as backward; they had to climb new heights, make further progress, and overcome fresh difficulties. They had their troubles—troubles peculiar to the present position of the gas industry—and they must meet them as their predecessors had met their earlier troubles. It was well that this should be so, because it was true that out of struggle came achievement, and out of difficulties arose success. The fifty years covered by the Association's activities had witnessed tremendous changes in the gas industry—changes in which, he ventured to say, their Association, in common, of course, with the parent Institution and the other District Associations, had played no mean part. They had seen the industry rise from a comparatively small and struggling one to what was now one of the greatest public services of the country. They had improved their engineering and their chemical methods, and had begun to realize what research could do for them; and as the result of all this they stood almost as a model of what a well-run industry ought to be. In their relations with the consumers, too, they had witnessed changes as drastic as necessary. They in the industry now realized that they were servants of the public, and they realized, further, that upon the quality of the service rendered largely depended the success or otherwise of the industry. In their relations with their workmen, also, there had been very pleasing changes—largely, no doubt, as a result of co-partnership and pension schemes, but even more because of the close personal contact that now generally existed between masters and men in gas-works, and the family feeling thereby engendered. He believed that in the gas industry to-day would be found the happiest and most efficient workmen in the country. ["Hear, hear."] As gas engineers they should be—and he believed were—proud of their heritage. He could conceive no greater combination of duties and responsibilities than were to be found in the combined engineering and chemical activities connected with the gas industry—particularly as in most cases they were combined with administrative and commercial interests as well. But if they were fortunate men, they must remember also that they were inheritors of a great responsibility, and had to add their quota to the sum total of the industry's effort. The gas industry had made tremendous strides; but there were still fresh fields to conquer, and old ones to cultivate. They must each and all determine to work so that they might deserve the praise and thanks of their successors as well as their predecessors deserved the thanks of the gas industry of to-day.

REMINISCENT.

Mr. W. E. PRICE, who also responded, said his father was one of the original members of the Association; and it was very nice to have put into their hands a brochure containing the names of the founders, Presidents, and Hon. Secretaries. Looking down the list, one saw the names of many old friends. A good many of them remembered Mr. W. H. Broadberry, of Tottenham; and they all knew his son, who was with them that evening. Mr. Arthur Valon was present; and his father was President in 1883. The father of Mr. C. F. Botley was one of the earliest members of the Association. Sir George Livesey and Dr. Carpenter had both occupied the chair. Among the Hon. Secretaries Mr. J. L. Chapman occupied the position for some twelve years; and no one ever met a better man. Then what about their friend "Jimmy," as they called him? What a good Secretary Mr. J. W. Helps was—always on the bright and sunny side. There had also been other excellent Secretaries. What a glorious past they had! What troubles had been got over by those who had guided the industry to the position in which it stood to-day.

THE GAS ENGINEERING PROFESSION.

Mr. HENRY WOODALL, proposing "The Gas Engineering Profession," remarked that the old engineers, besides being kindly men, were men of high character, such as one felt proud to follow. They were also, many of them, born leaders of men. They all knew how much they owed to Sir George Livesey in many ways; but perhaps the things they admired him for most were that splendid fight in

1890, and then the still more splendid resolution he made that, so far as in him lay, there should be no more strikes, with their disastrous consequences. Gratitude to him was felt by all for his great co-partnership scheme, which so many of them had adopted, and which had been so ably carried on and extended by Dr. Carpenter. Those engaged in modern gas-works required to possess almost every kind of engineering knowledge; while distribution became a more and more difficult problem as the towns and cities grew. More than this, they needed a sound chemical knowledge, to see that their residuals were properly treated. The Association had numbered among its members many of the most eminent men in the profession; and if the older men who had gone were alive now, they would not be ashamed of the present representatives of the industry. Many modern gas-works were models of good engineering; and if he might mention one, he would refer to those new works at Pitwines, Poole, which, besides being efficient, were beautiful. It was right that they should honour the designer, their President. Then they had also to deal with the public, which brought in the human interest, and added attraction to their work. They ought to be proud that one of their members, Mr. Thomas Glover, who had lived for about a quarter-of-a-century in Norwich, had so far won the esteem of his fellow-citizens that he had been elected Lord Mayor. [Applause.] Sometimes he thought, when reflecting upon how much was required of them, that they did not take quite the position in the engineering world that they should. Perhaps it was because gas men were so modest that people hardly realized what they owed to them, or what a great amount of knowledge was required to provide their commodity properly. This was hardly an occasion on which to quote figures; but he would like to mention two, and leave the members to draw their own conclusions. Fifty years ago, when the Association was started, one of the London Gas Companies were buying coal at 7s. 9d. per ton f.o.b., and the price of gas was at that time 3s. 7d. per 1000 c.ft. That same Company were purchasing the same coal at the beginning of this year, and paying 20s. 9d. per ton f.o.b.; and the price they were charging for gas was 3s. 7d. per 1000 c.ft., as it was fifty years ago. These were figures of which he did not think they need be ashamed. It had been said that coal was the greatest asset of this country; and he did not believe anybody would deny that the gas engineer made better use of it than any other person. Dr. Carpenter was to reply to this toast; and among the many reasons why they admired him was because he took a pride in getting the very best out of the coal he used. He took the greatest trouble in buying it, tested and carried it efficiently, and every product he made from it was of the highest quality. Might the use of gas increase—and he believed it would—until the time came when no coal would be utilized in their cities which was not carbonized in closed vessels. He believed the future held even greater things in store for them than the past. They were attracting to their profession young men of good education, ability, and keenness; and they were taking advantage of every scientific aid.

LESSONS OF THE PAST.

Dr. CHARLES CARPENTER said he hoped he might be pardoned if, at the outset, he referred to the admirable speeches that had been made by the brothers Woodall. It was a great pleasure to think that so great an engineer—one to whom the industry owed so much—as the late Sir Corbet Woodall was represented at that gathering by the next generation, which had proved, and would continue to prove, itself worthy of its parentage. They might learn a good many lessons from what had gone before; and while they attached importance to the present and the future, they must not forget what they owed to the past. They heard to-day, for instance, much of the examples of gas lighting which distinguished various parts of London north and south of the river; and yet it must be something like 45 years ago that the late Sir Corbet Woodall set himself to work to show how the illumination of the thoroughfares of this mighty city could be improved and increased by the adoption of new types of lanterns fitted with the latest patterns of burners. That installation was at the time an admirable example of what could be done; and it also formed an object-lesson for municipalities other than those in London, who came to see it, and to take the knowledge to their respective towns. They had before them in a booklet a list of the Presidents and Hon. Secretaries of the Association. It was difficult to attach the proper amount of value to the work done by the Secretaries; nor, indeed, was it possible for them to estimate to what extent the position of the Association to-day depended upon the work the Secretaries did in the past. The late Mr. Chapman had been spoken of. He was the first, and continued to be Secretary for many years; and later on he was one of the founders and original members of the Institution of Gas Engineers. Then there was Mr. Helps. It would require all the remarks they had time to make to do justice to the work Mr. Helps did, not only for the Association, but for the industry. ["Hear, hear."] One heard now from time to time suggestions about research; and yet how many of them remembered the years and years that James Helps had devoted to the application of research to the gas industry. He went even further, and when the Croydon Company took over the works at Caterham, Mr. Helps was exceedingly anxious that they should be utilized for the purpose of research into the problems of coal carbonization. Again, they must not forget how much they owed to the Woodall family for what had been done to make the experimental installation at Leeds worthy in every respect of its name. Mr. Helps was not only impressed with the importance of investigation, but he took every opportunity of putting it into effect. Then there was one other departed Secretary, with regard to whom he would like to say a word, and that was their old friend Mr. Browne. His tenure of office was comparatively short—not like the long eighteen years of Mr. Helps (with the one interval when he went to India, and his brother Douglas took his place, and admirably carried on the "Helps tradition"). They owed very much to all these gentlemen, and it was right that they should remind themselves of it on this occasion; but even more important than these records was the record of work that had been done by the Association. Over forty years ago they were discussing the question of "The Present Position of Electric and Gas Lighting." It was well to bear this in mind, at a time when they were having it dinned into their ears that the electrical industry was a new one, and had not had a proper chance of developing. It had had a great many years in which to develop; and yet it seemed to-day that it was to be bolstered-up by politicians, who, having cured all the real ills, must seek imaginary ones in order to justify their existence. It was a mistake to assume that the great engineers of the past were merely technical men. They had a strong commercial as well as technical instinct; but it was not in many cases so keenly developed as it had of necessity to be to-day. One point upon which they might pride themselves was that the gas industry had been carried on with an extraordinary absence of mishap to life or limb. One of the greatest testimonials to the ability of the gas man of the past and of to-day was the remarkable manner in which he had been able to supply the public with gas, and at the same time to ensure complete safety with regard to its use.

THE WORK AT LEEDS.

The future of gas had been referred to; and there it was pleasant to think what very great attention was being bestowed upon the important work carried out at Leeds. Here, again, they owed to the engineers of the past, and not to those of the present, the inception of that magnificent and useful organization. It was the fact that Sir George Livesey first interested himself in the matter; and it would be remembered that when he died the question arose as to what could be done to perpetuate his memory. Thus was the foundation laid of the Professorship at Leeds which had done such admirable work in placing the industry upon a sound and sure basis. There had been recently an appeal in respect of Leeds University. He did not know to what extent it might be possible for them as an Association to support the work that Leeds was carrying on; but if something, however small, could be contributed as an earnest of this obligation to Leeds, he felt sure the example would be a good one. Of late years, he himself had been in the habit of plotting-out the details of gas supply, in order to ascertain the variations in consumption. It was pleasing to record that, except for the slight reduction caused by daylight saving, the use of gas for lighting purposes in his area was very large indeed. He hoped no one would run away with the idea that gas for lighting purposes was gone. Before sitting down, he would like to make an appeal to Mr. Milne Watson. From time to time it was necessary to consult their friend "Field" in matters pertaining to gas; and the other day he himself was seeking some information with regard to yield of therms per ton of coal. Naturally he turned up "Field's Analysis;" but, to his great surprise, he could not find what he wanted. That was to say, it was not possible to ascertain from it how many therms of gas were produced per ton of coal. It was clear that they wanted all the help they could get in these matters, owing to the conditions they had to meet; and he would seriously ask Mr. Milne Watson to try and get Mr. Ibbs (whose work they highly appreciated) to bring "Field" a little more into line with modern practice. If they could have such information as they were in need of expressed in the terms of the article they were manufacturing and selling, it would help engineers in a direction in which they needed all the assistance they could get from the accounting mind.

THE LORD MAYOR OF NORWICH.

The PRESIDENT at this point announced that a telegram in the following terms had just been received from Mr. Thomas Glover, Lord Mayor of Norwich, and a Past-President of the Association:

> "The Lord Mayor of Norwich greets his friends of the Southern Association, and regrets his inability to be present at the jubilee dinner. May the next fifty years of service be as useful to the industry as the past."

THE VISITORS.

Mr. R. ROBERTSON (the newly-elected President of the Association) had charge of the toast of "The Visitors," which he submitted in a most witty speech. In more serious vein, he remarked that any occasion which could gather together such a distinguished company as their guest, justified itself. Lieut.-Col. Woodall, an honorary member, was a very old friend of the Southern Association, and was closely connected with Sir Arthur Duckham in the launching of that enterprise which had made for itself a world-wide reputation. There were also two distinguished gentleman they were proud to include among their ordinary members—Dr. Charles Carpenter and Mr. Henry Woodall. As a scientist, engineer, and administrator, Dr. Carpenter had a unique record. They acknowledged the debt the gas industry owed to him for so freely placing at its disposal the results of his own labours and of those of his admirably equipped research department. Then there were the President and Secretary of the Institution of Gas Engineers. It was safe to say that at no stage of its history had the prestige of the Institution stood higher than at the present moment; and they owed this very largely to the energy and organizing ability of the genial Secretary, Mr. Walter Dunn, and to the long line of distinguished engineers who had occupied the Presidential Chair. No one had better deserved the honour of being President than Mr. Charles Botley, the present occupant of the chair, whom they were proud to count as one of their own members. They had also with them representatives of the Technical Press, and no industry was better served in this respect than was the gas industry. Others they were delighted to have with them included several Government officials whose duties brought them into close touch with the gas industry. There was their old friend Mr. Swain, Technical Adviser to the Gas Referees. They were glad to have an opportunity of paying tribute to the courtesy and efficiency with which this Department functioned; and in this Mr. Swain played an important part. Further, there were Dr. Lewis Bailey, the Chief Alkali Inspector, and his assistant, Mr. F. Napier Sutton. Dr. Bailey had

gained the confidence and the esteem of the gas industry. He appreciated the difficulties of gas engineers, and laid himself out to help them. His reports were filed as valuable works of reference. Last, but not least, they had with them Mr. Milne Watson, who was to reply to the toast. It would be absolutely impossible to enumerate all the services Mr. Milne Watson had rendered to the gas industry. During the trouble and stress of war, gas men got into the habit of looking to him for a lead; and in the no less troublous times of peace, this habit had continued. The number of responsible positions he held and the onerous duties he performed were extraordinary.

BEST QUALITY ONLY.

Mr. D. MILNE WATSON began his response by declaring that he did not feel in the least like a visitor there that evening. He had known the Southern Association ever since he came into the gas industry; and that evening he found himself in the midst of friends. He wanted to say in a very few words how glad he was to be present, and how much he appreciated the work that the Association did. Probably it appealed to him even more than to some of those present, because he was a layman, and knew how hard a task it would be to administer a large company and to help in directing a great industry like theirs, unless there were such bodies as the Southern Association behind him. The problems which faced them to-day were many and difficult. There were, of course, their ordinary troubles and difficulties; but there were certain special ones at the present moment which required the attention of the whole industry, and of those who helped to administer it. First and foremost among these was the great question of electricity. They did what they could by throwing off the robes of modesty which they had worn so long, and telling Members of Parliament and others what a great industry the gas industry was, and how it was helping to conserve coal and to make the cities more healthy. But the real essence of the matter was in their being able to make the best gas, and also to supply it in a perfect condition; and this was an engineering question in every sense of the word. The way to deal with electricity was not really by public speeches, but by giving an efficient supply of gas. That was the way to "keep their end up" against electricity. ["Hear, hear."] Then there was the question of tar and bitumen. The gas industry had their tar to dispose of; and the only way to fight bitumen was by seeing that this tar was something which would really be satisfactory and useful. No amount of propaganda and advertising—which were quite useful, and all to the good—would carry weight unless the tar they supplied was of the right quality. This, again, was an engineering question. Then there was low-temperature carbonization. They were up against this as a cry of politicians. He did not propose to discuss this subject that evening. The industry believed that high-temperature carbonization was the thing for gas undertakings; but, at the same time, there was no use shouting high-temperature carbonization, unless they could show that it was the best and most scientific method of treating coal. Therefore, once more, it came to be an engineering question. Next there was the matter of coke. They heard that on the Continent, and even at home, people were beginning to use coke-oven coke for domestic purposes. They were breaking it; and in Scandinavia and other places they were using it instead of the gas coke which they had been burning for generations. The only way to beat coke-oven coke, and to "keep their own end up" in this respect, was to supply gas coke of a constant quality and size, which was what the people needed to meet their requirements. This, once more, was an engineering question. He would not occupy their time by pursuing further this line of thought; but he would like, in conclusion, to say how much he appreciated as a layman the scientific work done by engineers and by the engineering associations, of which the Southern Association was one of the greatest representatives in the country. It was a delight to find himself in the midst of a gathering of gas engineers and managers, who were working together for the good of the industry, and seeing that their products—gas and residuals—were absolutely of standard qualities, and such as would command respect and a ready sale in the world's markets.

A GREAT OCCASION.

Mr. C. F. BOTLEY (President of the Institution of Gas Engineers) also made response to the toast, remarking that he had been a member of the Southern Association all his professional life. He felt that this was a great occasion, and one which would be looked back upon with very pleasant recollections in the future. He had personal knowledge of the splendid work that the Association had done. It would be noticed from the souvenir booklet that the first President of the Association was Mr. A. H. Wood, the then Manager of the Gas-Works at Hastings; while his own father, Mr. C. E. Botley, was one of the earliest members. His grandfather and an uncle had also been members. Thus he had very deep-rooted affection for the Southern Association; and he had personally had the greatest possible help on all occasions from his membership of it.

COULD NOT THE METHOD OF RESEARCH BE EXTENDED?

Dr. T. LEWIS BAILEY (Chief Inspector of Alkali, &c., Works), replying, too, for the visitors, said the occasion added one more to the pleasant memories which he would carry along with him in the years that were to come. The gas industry was only twice the age of the Southern Association; but a great deal had happened in these hundred years. They had gone on until now the industry covered too wide a field for any one man under the rank of a genius to tackle the whole of the details; but there were men who specialized in various directions, and who were capable of doing so. This being the case, he was led to ask whether the method of research which they were carrying out at the present time in such a noble manner could not be extended. There were many men who were investigating problems and difficulties that they were up against; but these men were handicapped by having to do their work "in between times." They were managers of works, and could not leave their duties except for short periods at a time; and the difficulties in the way of carrying out work of a research character intermittently were almost insuperable. In order to carry out research of any kind satisfactorily, a man must have a pretty free hand with regard to his work, and must be kept as far as practicable clear of other disturbing influences. He should be able to devote at any rate the bulk of his time to the research. Again, there might be men who wanted to carry out research on problems they came up against, but who had not the special engineering or chemical knowledge requisite. Therefore he suggested it might be possible to extend the method of doing research work which existed in the gas industry at the present time. He admired the way in which they elected their Presidents. They had elected last year a President who, in his address, gave them a lot of problems which needed working out. Who was going to work them out? Now they had elected for their next President one who said: "There is no finality." This was an expression that he (the speaker) loved very much. There was no finality. There was continual change; and continual change meant continual research.

"FIELD" AND THERMS.

Mr. MILNE WATSON said he was sorry that he had neglected to reply to Dr. Carpenter's suggestion that he should bring influence to bear on Mr. Ibbs to put the information in "Field's Analysis" on a thermal basis. He would do his best.

The proceedings were brought to a close by a hearty vote of thanks to Mr. Moon for his conduct of the affairs of the Association. This was passed on the proposition of Mr. A. E. BROADBERRY.

INDUSTRIAL DISTILLATION.*

Reviewed by H. J. Hodsman, M.B.E., M.Sc., F.I.C., Department of Coal Gas and Fuel Industries, University of Leeds.

Distillation is one of the oldest arts of chemical manipulation. The still has usually been symbolic of the alchemist whose terminology still clings to the apparatus and its use. By long experience the distillation process has been made very effective, though by purely empirical methods. Separation by distillation, however, provides abundant scope for the application of physical and physico-chemical principles. And yet few have tried to bring these principles into harmony with the design and operation of industrial stills. In English, Young's "Fractional Distillation" deals essentially with the science of the process, but Hausbrand, above all, has endeavoured to harmonize the design of stills with theoretical requirements, and claims to have tested his views in the drawing office and works of a constructional chemical engineer. In these days when competition is keen, it is extremely desirable that the designer of plant shall be able to meet the necessary requirements of a process without unnecessary expenditure of materials and labour. Dr. Tripp has, therefore, earned the thanks of those chemists and engineers concerned, by placing Hausbrand at their disposal in the English language.

In the first part of the book the author works out his theoretical analysis of the distillation and fractionation process based on certain assumptions which will generally be conceded. The central feature of this method is the development of an equation for calculating the heat necessary to produce a certain grade of product from a given binary mixture, assuming knowledge of the thermal properties of the mixture. It is interesting, then, to see how he deduces, from these considerations, the answers to a number of practical problems which must occur to everyone concerned with the design of stills. These considerations, it may be said, are of very general application.

In the second section, he applies this theoretical treatment to specific problems of the separation of technical mixtures of water with alcohol, acetone, methanol, acids, and ammonia, and also liquid air. Strange to say, the problems of benzole or tar distillation are not mentioned. Consequently, the value of the book will be limited for readers of the "JOURNAL." For them the book would appeal rather because of its treatment of the theory of still design and operation. This is, nevertheless, something considerable, for no one can study the book without gaining insight into the basic principles of commercial distillation.

The third section consists of tables of data to accompany the treatment of the second section.

Finally, Dr. Tripp has tried to avoid the too literal rendering of the German original, and by a free translation has succeeded in making the book more readable to the English than might have been anticipated from the somewhat solid nature of the contents.

* **Principles and Practice of Industrial Distillation," by E. Hausbrand Translation from the Fourth German Edition by E. H. Tripp. Published by Chapman and Hall, Ltd.; price 21s. net.**

International Critical Tables.

The National Research Council have contracted with a reliable house to publish the "International Critical Tables of Numerical Data of Physics, Chemistry, and Technology" in five volumes. Members of scientific and engineering societies may purchase the volumes at manufacturing cost, $35, provided applications are filed with the National Research Council, B and 21st Streets, Washington, D.C., prior to 1926. The price after this will be $60 for the complete set.

NOTES ON AMERICAN GAS PRACTICE.

By G. M. Gill.

[A Paper, illustrated with lantern slides, read before the Southern Association of Gas Engineers and Managers, Nov. 18, 1925.]

As some of my fellow-members know, I have paid two visits of investigation—one recently—to the United States, with a view to studying American methods, and to learn what was applicable to our conditions here, and also what it was advisable to avoid. Your President suggested that I should read a paper, and give you some particulars of what I have seen in that country. This I am proposing to do with a number of lantern slides; and I am therefore limiting this paper to a written description of what I shall describe to you with the aid of illustrations.

During my trip this year I visited New York, Philadelphia, Rochester, Detroit, Chicago, Milwaukee, Pittsburgh, and a number of smaller towns in the United States; and I also went to Montreal and Toronto, in Canada. I spent an interesting week-end at Niagara Falls, and attended a gas conference at Atlantic City. Everywhere I was most kindly and hospitably received. The American and Canadian gas engineers take a pride in doing everything possible to give you all the information you want, and generally to make your stay instructive and interesting.

Type of Gas Made and Supplied to Towns.

I propose here to deal only with manufactured gas, and to exclude natural gas, of which very large quantities are supplied. There are 1066 undertakings supplying gas to towns, of which only 51 are owned by municipalities. Of these:

431	supply	carburetted water gas only.
201	,,	coal gas only.
151	,,	coal and water gas.
88	,,	gas purchased in bulk.
82	,,	bye-product coke oven gas.
49	,,	water gas and oil gas.
33	,,	oil gas only.
31	,,	a variety of gases.
1066		

The quantities of the various gases supplied by the above undertakings are as follows:

	Mill. C.Ft.
Carburetted water gas	230,206
Coke oven gas, purchased and distributed	65,872
Coal gas	58,885
Natural gas purchased and mixed with manufactured gas	38,410
Oil gas	24,627
	418,000

The extent of the gas industry in the United States will be better realized if I state that 241,626 million c.ft. is supplied by gas undertakings in Great Britain. All the above figures refer to the year 1923.

The consumption per head of population in the United States has increased from 7335 c.ft. in 1913 to 9550 c.ft. in 1923—an increase of 30·2 p.ct. I mention this, as some people outside the gas industry have the idea that gas supply is a decaying one; and I think that if such people were told that gas supply is steadily growing in a country like the United States, which the man in the street looks upon as a progressive and up-to-date country, it would go far to convince them that the use of gas is likely to grow in popularity.

Oil Gas.

The oil gas mentioned above is largely supplied in San Francisco and towns on the Pacific Coast. It is made in a type of plant not unlike that used for making water gas, in which oil is sprayed, in the presence of superheated steam, into a generator filled with checker brickwork. This produces a gas alike in composition and general characteristics to straight coal gas. It is an intermittent process; the checker work being heated by the combustion of oil. Approximately it takes 8 gallons of oil of a wide range of quality to make 1000 c.ft. of gas; while the steam is generated by burning the lampblack formed in the process. In countries where oil is plentiful and cheap, it would appear to be the best means of making gas.

Quality of Gas Supplied.

As is generally known, there is no restriction in regard to percentages of water gas and coal gas supplied, nor is any attention paid to the percentage of carbon monoxide in the gas. Practically all the gas sent out in the United States ranges between 500 and 600 B.Th.U. (gross), though there are a few towns in which both higher and lower qualities are supplied. In Canada, however, a quality of 450 B.Th.U. has been widely adopted.

Use of Coke Oven Gas for Town Supply.

The above figures show how largely coke oven gas is used for town supply; and this practice in the United States is growing very rapidly. In 1921, 37,392 million c.ft. of coke oven gas was purchased and distributed for town supply; while in 1923 this had increased to 65,872 millions. This shows the speed with which the Americans develop anything which they consider advantageous. Those districts furnished wholly or partially with coke oven gas—and I visited several—are in every way as well supplied as those relying entirely on gas-works. Like many others I am strongly of the opinion that more use should be made of coke oven gas for town supply in this country.

Increasing Quantity of Coal Gas.

In the United States there is a strong tendency to increase the quantity of coal gas made, at the expense of carburetted water gas and natural gas, for the reason that oil production in the United States is not keeping pace with the demand for oil, and natural gas supplies are failing in many districts. During the next few years there will undoubtedly be a great development in the installations of coal gas plant in America. In Buffalo, for instance, which was recently entirely supplied by natural gas, there is now a 5 million unit of continuous vertical retort plant to supplement the failing supply of natural gas. In Pittsburgh, which has been entirely supplied with natural gas, it is fast failing. It may not be generally known that the collection of natural gas is very expensive, so much so that the capital expenditure in such undertakings is frequently 50 p.ct. higher than in those supplying manufactured gas.

At the beginning of this century American gas practice was very largely similar to that in this country, and different only in comparatively unimportant respects. Since then, and particularly during the past ten years, the gas and coke oven engineers have been developing their methods most energetically, and as a result new ideas and systems have been adopted on a wholesale scale.

Coal Handling.

Much of the plant is similar to that used in England; but there is a noticeable tendency for the American engineers to use large bridges, or Temperley transporters, as these are usually termed here. Coal taken direct into retort house, or to and from uncovered stores, is frequently handled on a bridge. Many of the American works have to carry very large stocks during the winter months, when the lakes are frozen over; and it is found that a bridge spanning the coal store for a considerable distance, and adapted for grabbing coal from steamer, barge, or railway wagon, into store or into retort house, with complete interchange facilities, is not only very convenient, but is also a true economy in a country where labour costs are very heavy.

Horizontal Retorts.

A considerable number of horizontal retort settings are still in use; but these are being more or less rapidly superseded by ovens and, to a lesser extent, by vertical retorts, chiefly of the continuous type.

The horizontal settings and retorts are almost invariably built of silica material, without combustion chambers as we understand them; the retorts being generally fitted with scrubber standpipes. The stoking machinery and the coal and coke-handling plant in horizontal retort houses is generally similar to that used in British gas-works. There is no doubt whatever that in America the horizontal retort is going greatly out of favour. It is generally considered to be too small a unit. The labour required in a retort house varies to a large extent with the number of charges; and a coke oven with a 15-ton charge requires far less labour, in proportion, than a retort with a 15-cwt. charge. In America, this makes a powerful appeal to the employer, who, it must be remembered, is paying from two to three times as much for his labour as the rate current in England.

Continuous Vertical Retorts.

These are making excellent headway in the United States. All installations are either of the West or Woodall-Duckham type. To my mind, it is very creditable for these two enterprising British firms to progress in the way they have in America. There is no doubt that the continuous operation of this type of plant appeals very much to the American mind. Being a good labour-saver, and having a flexibility in the quality of gas which can be made, it works well in harness with water gas plant, the use of which is influenced so much by the varying price of oil. The only criticism which I heard of this type of plant was that the coke made is too soft for their requirements, which are largely for closed heating stoves for domestic use.

Intermittent Verticals.

Some few years ago—in fact, during my previous visit to America, in 1920—it looked as though an improved type of Dessau retort, heated by mechanical producers working largely on breeze, was coming into favour; but more recently there has been a tendency to instal other kinds of plant. The intermittent vertical retort has done well, but other types appear to have done better. The capital cost of the installations has been very high, the size of retort unit has been small, and there has been the very real difficulty of gas pressure on the bottom of the retorts, with the inevitable leakage of gas—too much of it being burnt at the lower mouthpiece, with destructive results on the ironwork.

Small Horizontal Ovens.

This type of setting, in which three ovens are built into the shell of a horizontal retort setting, is growing in popularity. A considerable number of these installations has been built in recent years. At one works I visited the ovens are of a size to carbonize 2 tons of coal per twelve hours. The ovens measured

12 in. wide, 8 ft. high, and 13 ft. 6 in. long, and were parallel from end to end. These dimensions can be varied upwards as required, to the full size of a coke oven.

The coal is dropped into the ovens through two or three openings at the top, being simultaneously levelled-off by a ram on the coke-pusher, which machine is also used as a door lifter. The doors are faced, and are opened and shut by means of eccentric fasteners and levers; no luting being used. A baffle plate is attached to the inside of the door to hold-up the charge in a vertical position. Each oven has one ascension pipe, and each setting of three ovens has a producer; but this is usually situated on the same side as the pusher, and has to be fed with cold coke—though in one works I visited, soft coal was being used as fuel. The coke is either pushed-out hot into a special truck, which is then hauled away for quenching, or it is discharged upon a sloping stage where the quenching operation is carried out, after which it is removed by a rubber belt conveyor—which, I might add, is universally used in America, and with great success, for conveying coke after quenching.

These small ovens, being built of silica material, and being only 12 in. wide, are readily carbonized in twelve hours. Their flexibility—in the matter of height and length—to suit local condition, their rectangular shape, with simple coal handling plant, limited ironwork on the top of the settings, and their small requirements in the matter of machinery, are all factors tending to cheapen the capital outlay on this type of plant. I was, in fact, informed that the capital outlay is certainly 25 p.ct. less than on a horizontal retort plant of the same size.

It struck me that these ovens would be particularly suitable for carbonizing coal which does not coke well enough for ordinary gas-works use, but which, in bulk, could be employed successfully. The coke shows a tendency to be harder than ordinary horizontal coke.

American Coke Oven Plant.

It must be borne in mind that the coke oven is the principal type of plant used for making coal gas in the United States. The coke oven has been wonderfully developed by the Koppers Company of America, and is a really splendid piece of plant, which has been admirably adapted to making an excellent quality and high production of both oven coke and coal gas.

The Americans have had the good sense to realize that, to work coke oven plant to the best advantage, it is essential to have a good market close at hand for the coke, gas, and other bye-products, and have appreciated that it is better to transport the raw material than the products derived from it.

As a consequence, the coke ovens and steel works have been built just outside large towns, which find a market for the surplus gas, coke, and other bye-products not required in the steel works. The steel works use all the larger coke, while the smaller finds a market in the neighbouring town. This policy has been, in my humble judgment, the greatest success, and has resulted in the production of relatively cheap steel.

This development has taken place in comparatively recent years; and it would seem to me to coincide with the period during which America has done so well in the steel trade. Is it not possible for the same development to take place in this country, and place us where we used to be—in the front rank of steel producers? In this connection it is idle to suggest that high wages make this impossible, for America is paying a wage two or three times higher than that paid in England, and yet is making steel at a price to compete in the world's markets.

Preparation of Coal—Characteristics of Good Oven Coke.

In coke oven plant the greatest care is taken to provide a mixture of coal of a nature which will make a coke of the correct characteristics for metallurgical work. The analysis of such coke will be in accordance with the following:

	P.Ct.
Volatile matter	2 or less.
Fixed carbon	86 or more.
Ash	12 or less.
Moisture	2 or less.
Sulphur	Less than 1.

Good oven coke requires to be of the correct structure, and physically strong, but not too dense to prevent the air from readily penetrating its pores. These physical characteristics have been very carefully studied by those connected with American coke oven plant; and they have evolved a system of working which, I believe, is different from that employed in this country.

In none of the American coke oven plants which I have visited has the coal been wetted or stamped prior to charging; but in all cases it has been a mixture of high volatile coal—in other words, gas coal—containing from 30 to 40 p.ct. volatile matter, and a low volatile steam coal with, approximately, 20 p.ct. of volatile matter. These coals will be mixed to give an average of 26 to 28 p.ct., or possible a little higher, of volatile content. In some cases a third coal will be introduced to neutralize a fault, or to improve the coke in some particular respect.

Breaking and Extraction of Foreign Matter from Coal.

As received from the mines, the coal contains some pieces of iron and wood, slate, iron pyrites, and other foreign matter; and this is extracted in a simple and effective manner in the coal breaker, which consists of a large drum about 14 ft. long and 12 ft. in diameter. The shaft on which the drum is revolved is set at a slight angle, and is constructed of steel plates perforated with 1½ in. holes. Inside the drum are fitted lifting plates, which lift the coal to the top of the drum and allow it to fall to the bottom. This has the effect of breaking it to a size which will pass through the holes. All foreign matter finds its way to the lower end of the drum, where it falls out, and is thus separated from the coal. The breaker revolves at a speed of about 12 r.p.m., and is housed in a steel casing to prevent the escape of dust. Each grade of coal used will have its own breaker, and be separately treated to this stage.

Mixing of Coals.

The broken coal is dropped into a hopper, from the bottom of which it is fed on to a belt which can be moved at any required speed. The quantity of coal on the belt is regulated by a form of adjustable gate, by which means the amount of coal can be kept constant. Thus the belt for the high volatile coal, of which there may be 80 p.ct. in the mixture, will run faster and contain more coal per foot run than the belt for the low volatile coal. By this means the correct proportions of high and low volatile coals to make any desired grade of coke can be readily obtained in practice.

Crushing of the Coal.

From the mixing belts the broken coal falls into a disintegrator, and is there crushed to a size whereby 95 p.ct. of it will pass through a ⅛ in. square mesh sieve. The crushed coal is then conveyed on a belt to the hoppers situated immediately over the coke oven benches. The effect of these carefully designed arrangements is to provide a coal which is uniformly mixed in any desired proportions.

Charging of the Ovens.

The coal charging plant consists of a motor-driven wagon running on rails on the top of the ovens. The wagon comprises four separate hoppers, each filled with a weighed quantity of coal. When an oven is to be charged, the wagon is emptied into four openings at the top of the oven. At the same time a levelling ram is propelled to and fro through an opening in the upper part of the oven, to level-off the top of the coal.

The Ovens.

These are of varying size, from 37 ft. to 41 ft. long, and from 9 ft. to 12 ft. 10 in. in height, with a tapered width which at the widest point is less than 15 in. The latest Becker type of ovens which I saw at the new gas-works in Chicago measured 41 ft. long by 12 ft. 10 in. high, by a varying width of 13¾ in. to 14¾ in. These were carbonizing from 11¼ to 11¾ tons per twelve-hour charge. The ovens are built of 95 p.ct. silica material, and from all accounts enjoy a life extending over many years.

The heating gas is either coal gas or producer gas; and the new installations usually provide for the use of either. If coal gas be employed, the air alone is heated by the waste gases; while if producer gas be used, both the gas and air are heated by the waste gases. Convenient means have been introduced to facilitate a change from one system to the other while the plant is at work. It will be appreciated that, with this arrangement, the amount of gas and coke made can be balanced with the demand to a large extent.

In all modern American coke ovens the extraction of heat from the waste gases is effected upon the original Siemens system, in which there are two heating chambers filled with checker work. The waste gases pass out through one chamber, thereby giving-up heat to the checker work, while the gas and air are passing in through the other chamber and extracting heat from it. Every twenty minutes or so the flow is automatically reversed. This system is found to be so effective that the waste gases, in spite of the very high temperatures used, pass away at less than 300° C.

The doors at each end of the ovens are still of the luted type in American coke oven works. These doors are lined with firebricks, and are held in position by means of various types of fasteners, which are tightened or loosened by a travelling machine used for removing or replacing the oven doors, and for propelling the coke guide along the stage. In some cases the doors are lifted clear of the ovens in a vertical direction by means of suitable power-operated mechanism, which can be set in motion at any part of the top of the bench.

The machinery required for operating a bench of ovens is as follows:

Pusher capable of serving 60 ovens.
Coal trolley capable of serving 120 ovens.
Coke quenching wagon capable of serving 120 ovens.
Stationary coke quenching spray and dwarf chimney capable of serving 120 ovens.
Coke dock capable of serving 120 ovens.

All machines except the pusher travel very quickly—a good deal faster than a retort house stoking machine.

In the old type of ovens the waste gases gave up their heat to the incoming air in the same manner as is general practice in modern retort settings; and in such ovens some 60 p.ct. of the gas made was used to heat the ovens. In the new type this has now been reduced to under 40 p.ct.

Mechanical Producers for Heating the Ovens.

It is considered in America that it is much better to employ all the gas made for town supply and for use in steel works than for heating ovens. Mechanical producers are now being largely used for providing the heating gas for the ovens. These producers are known as the Koppers-Kerpely type, and have

been admirably adapted to do excellent work in heating ovens. The installation, which consists of producers with revolving grates, overhead coke hoppers, waste-heat boilers, gas exhausters, air fans, and scrubber coolers, is housed in a building.

Each producer is 7 to 10 ft. in diameter internally; the lower half of which consists of a water jacket, which prevents clinker from adhering to the side walls, and provides hot feed water for the high pressure waste-heat boilers, and low-pressure steam for the grates of the producers. The top half of the producer lining is built of firebrick; but this is situated above the clinkering zone. The producers are fed intermittently with small coke; but this can be mixed with upwards of 20 p.ct. of fine breeze, if desired. The producer gas made contains approximately CO 30 p.ct., H_2 10 p.ct., and CO_2 4 p.ct., with a gross calorific value of 130 B.Th.U. About 11 lbs. of dry coke is required to carbonize 100 lbs. of (wet) coal. If an admixture of fine breeze and coke is used, as at the new gas-works in Chicago, this quantity will be increased to about 12½ lbs.

The producer gas first passes at a temperature of 700° C. through waste-heat boilers, in which sufficient high-pressure steam, amounting to ¾ lb. per pound of fuel, is produced to drive the entire producer plant. The gas is then cooled by direct water contact in vertical scrubber coolers, which remove any dust present in the gas. It then passes through turbine-driven exhausters, and is pumped to the ovens. These exhausters are fitted with water sprays, which provide additional cleaning and cooling capacity. A gasholder floats on the main to the ovens, and provides for any lack of uniformity in the make of producer gas. The plant is entirely equipped with air, gas, and steam meters, thermometers, and pressure gauges; and very complete and regular records are kept of the working.

Considerable importance is attached to the cooling and cleaning of the gas prior to its use in the ovens. It permits of metal cocks being used, thus making it possible to control accurately the heating of the ovens; while the freedom of the gas from dust prolongs the life of the ovens and regenerators, and saves labour in cleaning. The producer gas and the air for its combustion are both heated by the waste gases leaving the ovens.

I was much impressed with these plants. Everything appeared to be working very well; and the engineers spoke highly of the whole installation in each works that I visited.

Coke Handling—Its Discharge from the Ovens.

The system adopted is practically identical in all the large coke oven plants; and being very effective, it is well worthy of a careful study by those who have to handle coke in large quantities. Situated on one side of the ovens, and running on a wide-gauge railway, there is a massive pushing machine. This consists of a ram operated by means of a rack-and-pinion drive, a smaller ram for levelling the charge of coal, a device for lifting off the oven doors, and gear for lifting and lowering the pushing ram, and for travelling the machine along the stage. The machine, though heavy in construction, is quite simple in design—a good deal more so than the pushers used in retort houses. The charges of coke push out quite readily; and there appears to be little or no trouble in this respect. The coke is pushed out through a guide on the opposite side of the oven to the machine. This serves the purpose of maintaining the charge in a vertical position until it drops into a wagon with a sloping bottom and with doors at the lower end.

Quenching.

The wagon is propelled in front of the ovens by an electric locomotive, which carries the charge—while still hot after its discharge—to a quenching station at the end of the bench of ovens, where it is quenched by a water spray; the steam, in some cases, passing up a dwarf chimney built round the spray. It takes about 45 seconds to quench a charge of coke. After quenching, the wagon is allowed to stand a few minutes to drain off the excess water, and is then hauled to the coke wharf, and there discharged.

Storage after Quenching.

The coke wharf (which is virtually a hopper), consists of a sloping stage, and is situated at a level immediately below the rails. Here the coke lies in a layer of about 12 in., or less, until it is cool enough, or until it is convenient, to remove it to the screening plant. At the lower end of the wharf there are continuous doors, which can be lifted to allow the coke to drop out over a feeding device on to a rubber belt conveyor, which carries the coke to the screens.

Removal of Coke to Screening Plant.

The feeding device consists of a continuous roller, the speed of which regulates the amount of coke passing from the wharf to the belt. This roller can be thrown in and out of gear, as required. The belt is found to be a very satisfactory means of handling coke, although this is still hot and occasionally contains a red-hot piece. I was informed that the wear and tear of these belts amounted to no more than 8¼ (4s. 2d.) per 1000 tons of coke handled. The coke is frequently carried a considerable distance, and up a fairly stiff gradient.

Screening the Coke.

From the belt, it is dropped on to a grizzly screen to remove all coke below 1 in. in size, above which it is used for metallurgical work. The coke passing over the screen is loaded direct into railway wagons, and is taken to the steel-works. For founders' use, it is specified that the coke must be over 2¾ in. in size; and for that reason not more than 60 p.ct. of the make can be sold for this purpose. In loading into these wagons, the drop of coke is minimized by allowing it to run from the screen on a small belt conveyor. This is raised and lowered as required over the wagons, which, in America, are of a size to hold 30 tons of coke.

The coke passing through the grizzly screen—and these are exclusively used for this purpose in America—is conveyed on a belt to a screening plant, usually consisting of the rotary type, to grade it into three or four sizes. The smallest, or dust, under ½ in., is used in mechanically-stoked boilers for providing steam; and the larger sizes are sold for domestic purposes. If mechanical producers are used for heating the ovens—and this is the latest practice—coke and breeze under 1½ in. are employed for the purpose. In many coke oven plants the screening arrangements are fairly extensive, to suit their local conditions; but the general nature of the plant is very similar.

Coke Oven Gas—Its Quality and Treatment.

The gas made has an average quality of 550 B.Th.U. (gross), and is similar in all respects to straight coal gas. At one time the gas was divided into rich and lean, the latter being used for heating the ovens; but this practice has been discontinued in modern plants. The gas, after leaving the ovens, is cooled and washed in Doherty washer coolers, described below. After being cooled, the gas is passed through "P. & A." tar extractors, and is then re-heated to 60° Fahr., prior to being bubbled through saturators for the direct recovery of sulphate of ammonia. The gas is usually completely stripped of benzole, and, if supplied direct to a town, is of course purified from H_2S; but, in some cases, it is supplied crude to gas-works, and is there purified.

The Coke Oven as a Gas Making Plant.

I am more familiar with the American than the British type of coke oven, though I have inspected a good many of the latter. The American oven has always impressed me most favourably; and so long as the coke finds a ready market, I cannot conceive of a better gas making plant for large gas-works. The yield and quality of gas and liquid products are quite satisfactory. The coke is, for the most part, large and dense, and is entirely suitable for foundry and metallurgical work, and for water gas making. The smaller sizes, screened from the make, or broken, would, I consider, be quite suitable for most of the purposes for which gas-works coke is sold in England. It must be remembered that gas coke is being used more and more for appliances where there is a sufficient draught, as met with in industrial furnaces, boilers, and closed coke stoves of various kinds; and therefore it is quite reasonable to suppose that such coke would sell more or less readily.

When it is considered that oven coke generally is lower in ash, moisture, and sulphur than is the case with gas coke, it is not unreasonable to suppose that these advantages would assist the demand for many purposes. Further, little thought has yet been given to the scientific preparation of coal for the production of a free-burning coke in ovens; and, to my mind, it is distinctly probable that, when a fraction of the attention that has been given to the careful preparation of coals for making good oven coke is devoted to the production of a free-burning coke, this problem will readily be solved.

The American coke oven is housed in no building, and the character of the plant is such as to indicate that the capital cost will be by no means prohibitive; nor should it compare unfavourably in this respect with other gas making plant. Its requirements in labour and in ground area are distinctly favourable. The usual British coke oven, I am sorry to say, does not compare at all well with the American type—certainly as a gas making plant—but no doubt the absence of demand for the surplus gas has resulted in little thought being given to this side of the question. If any gas engineer is contemplating the installation of coke oven plant, I would advise him to study the American design before coming to any decision.

Condensers—The Doherty Washer Cooler.

There is no marked difference in the type of condensers used from those employed in England, except that frequently the condensing plant will be divided into two sections, primary and secondary, the former being placed before, and the latter after, the exhausters.

The Doherty washer cooler is a widely-used piece of plant. It cools the gas in actual contact with its own condensate, and at the same time does an appreciable amount of work in tar extraction and in the washing and scrubbing of gas. In principle it is very similar to a tower scrubber, but with this difference—that the liquor on its exit from the bottom of the vessel is circulated through cooling coils and is then returned to the top, and so on. The cooling coil consists of batteries of pipes, each of which is fitted internally with a water pipe; while its exterior is cooled by water sprays. Thus the liquor which flows in the annular space between the two pipes is cooled on both sides.

It is claimed that, by direct contact, a higher efficiency is obtained than is possible with ordinary condensers.

Exhausters.

These are exclusively of the Roots blower type, and are

usually made and supplied by the Connersville Blower Company. They are beautifully made machines, in which there is no metallic contact between the blades and the casing; reliance being placed entirely upon the exact and extremely close fit to prevent gas slipping back. The efficiency of these machines is distinctly high, while wear and tear is very light. The same type of machine is largely used for boosting up to 10 lbs. pressure; and I saw one giving good service as an air blower on a water gas plant. The same machine, with slight variations in construction, is also finding great favour as a station meter; but this will be dealt with later.

Tar Extraction and Washing and Scrubbing.

More use is made of "P. & A." tar extractors, while less use is made of Livesey washers (or those of a similar type), of centrifugal vertical washer scrubbers, and of horizontal rotary washer scrubbers, than is the case in England. On the other hand, the design of tower scrubbers has been improved to bring the gas into closer contact with the liquor used.

Purifiers.

Originally it was customary to employ the same class of purifiers as those used in this country—that is to say, of cast iron and shallow depth—but during the past twenty years or so round and square steel purifiers of a depth of 10 ft. to 12 ft. and more have been very commonly installed. I have seen many installations of steel purifiers; and quite recently a splendid plant consisting of large round purifiers of 45 ft. diameter, with an overhead travelling crane and grab, has been erected at the large Astoria Works of the New York Consolidated Gas Company. The material is discharged from the purifiers by grab into trucks alongside or into a side store; the filling being carried out in the reverse direction by the same grab.

These purifiers, as is customary in America, work with deep tiers of oxide of about 5 ft. in thickness. It is usual to mix the oxide with planer shavings, in the proportion of about 50 lbs. of natural ore per bushel of shavings. So far as I could learn, they have no more trouble with back-pressure than we do with our shallow tiers. The greater depth lends itself to discharge by grab, for which purpose it is necessary to use a strong grid; but these would in any case be required for the deep tiers.

In America one very often sees deep round steel purifiers built on ground level in the open. Two 5 ft. tiers of oxide are used, and for discharging purposes there are doors on the side, through which the material will be thrown out by shovel. For filling it is usual to employ a portable belt conveyor which tips the material through the top of the purifier. Many of these purifiers are now being adapted for discharge by grab. To protect them from the cold weather, a layer of slag wool is used on the side, with 4½ in. of brickwork built outside it. It is usual to pass the gas into the centre of these boxes, half going up and the other half down.

With regard to internal and external corrosion of the steel purifiers, I questioned several American engineers; and in no case did they speak unfavourably about them in this respect. They stated that it was slight, and that it was only necessary to paint them from time to time. Certainly I saw no evidence anywhere of serious corrosion, although many of the boxes had been in use for twenty years or more. Having seen these purifiers, and appreciating the advantages of larger purifying capacity on a given area, their cheap construction, and other incidental advantages, I should not myself hesitate to use the same type in this country.

Internal Revivification of Oxide.

In two large works I inspected a system of internal revivification, which had been successfully in operation for many years. For this purpose a fan is used, and this is connected to all the purifiers by two air mains (inlet and outlet), with the necessary valves. When a purifier is temporarily shut-off for revivification, the fan inlet is connected to the purifier outlet and the fan outlet to the purifier inlet. At first the gas only left in the purifier is circulated through it; but gradually, by means of a regulated attachment, a small quantity of air is drawn in and circulated with the gas, while on the outlet a corresponding amount of mixed gas and air is let out.

By this means sufficient oxygen is blown through the purifier to revivify the oxide; while at the same time the amount admitted is under perfect control, as are the temperature and conditions inside the purifier. If there are any signs of heat or combustion, as can be determined by observation or by thermometers on the exit pipe, the air inlet and waste products outlet are immediately shut, and the fan then continues to circulate a diluent gas of CO_2 and N, which immediately extinguishes any combustion. The system is easily and cheaply installed; and so far as I could ascertain, it approximately halves the number of purifiers discharged.

Station Meters.

For this purpose, the water meter as used in England is being ousted by "Connersville" meters of the same general construction as is used for exhausters. These latter machines are being widely installed in America, and I saw a great many of them in operation. When used as a meter, the impeller shafts are mounted in ball bearings, and are designed to receive the gas at the top and discharge at the bottom. The meter displaces a known volume per revolution, *plus* gas slip, which is determined by testing each meter in the shop; a calibration curve being then supplied, from which the slip under any conditions can be determined.

In addition, it is usual to equip a meter with a pressure-volume-temperature-time-recording gauge, which gives a complete record on one chart of the volume of gas passed, the inlet pressure, the inlet temperature, and the rate of flow. The chart is driven by the meter, by which means a true average may be determined and accurate corrections can be made for pressure and temperature. As a matter of fact, for meters of 50,000 c.ft. per hour and upwards the gas slip amounts at normal ratings to less than 1 p.ct., and to little more for smaller meters. Consequently gas slip is not a serious matter.

This type of meter is not only accurate in working, but it also shows a small back-pressure of under 1 in.; and, further, it occupies considerably less ground area, and is substantially cheaper, than a drum meter, against which these meters have been tested on many occasions, and have been found to be, according to American engineers, quite accurate. I was much impressed with the value of this invention; and to see five 15 million c.ft. a day meters installed in a small room in the new Chicago Gas-Works was an eye-opener, when I appreciated what a large and expensive building would be necessary to house water meters of the same capacity.

Gasholders.

Except that the Americans use no spiral-guided gasholders, and that the height of the holders is greater in proportion to their diameter than is usual in this country, I saw little about which to make any comments, other than the rapidity with which they have adopted the tankless holder. Gasholders of this type to an aggregate capacity of 75 million c.ft. have been ordered in little over twelve months, some of these being of 15 million c.ft. capacity. This shows how sound the American engineers consider the new type of construction; and, of course, it dispenses with the water seal, which in a cold country—as is so much of North America—is a great nuisance.

I saw one of these holders in the outskirts of New York. It was of 3 million c.ft. capacity, and only just completed. The Americans are using much larger plates than are employed on the Continent. I noticed on this holder that the plates were 22 ft. in length; and on larger holders the plates are still longer. This makes for cheap construction. The large number of pumps used—there was one to every 44 ft. of circumference—would seem to be rather excessive; and there certainly is scope to improve upon the existing method of distributing the tar to the seal.

To my mind there are certain excellent features of this type of holder. Dispensing with the tank and the seals, and uniformity of pressure at all positions of the holder, are great boons. The pressure can also be increased or reduced by means of weights placed on the piston; while the permanent covering of the inside plates of the holder with a coating of tar should effectually deal with internal corrosion. Further, the stability of this type of holder should be materially greater than that of the ordinary type; while the abandonment of the tank and the cups and grips ought to cheapen very materially the cost of construction.

Portable Conveyors, Elevators, and Cranes.

These are largely employed in the United States for all purposes; and frequently these conveyors will be used in relays, as, for instance, in stacking coal or coke. I am inclined to think that the American type of portable conveyor is more readily adapted to varying conditions of work than those made in this country. Certainly they are used far more widely there than here. Portable cranes and elevators on caterpillars are also much employed for odd work in gas-works. Requiring no rails, they are very convenient for general use.

Fine Coke Breeze in Mechanically Stoked Boilers.

For providing power for running the plant, it is general practice in the American coke oven plants and gas-works to use the fine coke breeze under ½ in. in size in mechanical stokers, usually of the Coxe pattern. These are of the water-tube type, are fitted with mechanical chain grates, and burn fine coke breeze most satisfactorily. I have seen large numbers of these boilers in use; and in all cases they were working well and were highly praised.

Water Gas Manufacture.

As is generally known, this is carried out on a very big scale in the United States. There it takes the place that coal gas does here. I found that a great deal of thought is being given to improved means of manufacture. The automatic operation of sets, several systems of which have been successfully developed, has become general practice. Exhaust steam, with the addition, in many cases, of steam accumulators, is widely used in place of live steam. The back-run system is already used in numerous plants; and the system itself has been substantially improved since it was first introduced.

Methods of handling and feeding the fuel into the generator have been simplified and improved. Bituminous coal is being used successfully in generators in large quantities; and in some towns this has made a material improvement in the cost of gas making. It must be borne in mind that, in many places, coke has to be purchased for water gas making; and as this is frequently expensive, it is cheaper to use local coal in its place. Water sprays are being employed in place of steam; and many

experiments are being carried out in this direction. It would appear that the successful introduction of the back-run system has stimulated interest in the operation of water gas plants.

It is usual to speed-up blast-fan engines for the blow, and to slow them down during the run. In one plant, I saw a large "Connersville" blower being used for the blast. This was at 2 lbs. pressure; and it was claimed that being—unlike a fan—a positive type of blower, it was possible to ensure the admission of any required quantity of air in a given time. Further, a great advantage of this type is that it is noiseless; and the hum of the fans, so often objected to, is thereby avoided.

It is customary to instal condensers on the outlet of the relief holder, by which means the flow of gas is more uniform, and the gas itself is cooler. I was much impressed with what I saw of water gas production; and I feel sure that developments in this country are certain to follow on similar lines.

DISTRIBUTION.

In the large towns it is becoming more and more common to rely less on holder pressure and more upon blowers. The plan adopted in Chicago, St. Louis, Milwaukee, and other towns, is to distribute the gas from the works at a pressure varying from 1 lb. to 10 lbs. by means of "Connersville" blowers—the same type of machine as there used for exhausters. These high-pressure mains are laid to form a network throughout the town, and are connected to low-pressure mains through a governor in each district consisting of an area of about one square mile. By this means, it has been found possible to cope with a largely increased demand for gas in populous cities.

The high-pressure mains are, for the most part, the original gas mains laid years ago, and are of ordinary socket-and-spigot cast-iron pipes with lead joints. In some cases a pressure of a few inches has given way to one of a few pounds, without any change of any sort being made in the pipe joints. In other instances the mains have been stripped and the joints caulked; while in some cases clamps have been fitted at every joint. American engineers state confidently that standard socket-and-spigot cast-iron pipes, with ordinary lead joints, are quite suitable for pressures of 10 lbs.; and that where changes have taken place, unaccounted-for figures have not been increased. However, in Chicago cast-iron mains with Dresser couplings are now being used for this high-pressure work. I am inclined to think that this is a provision for many years to come, when much higher pressures may be used.

TRENCHING MACHINES.

In the United States it is common practice to dig pipe trenches, wherever possible, with trenching or ditching machines. These machines are found to reduce the cost of this work to one-third, or one-half, of hand labour, and, what is often even more important, to speed-up the time during which a roadway is being cut up and traffic interrupted. These machines cut a trench very rapidly, and are largely used in thoroughfares where, at first sight, it would be thought inexpedient, as being likely to meet obstructions and damage other pipes and cables. Care is, of course, taken to ascertain the nature of obstructions likely to be met; but, apart from this, the drivers appear to be able to stop the machine before it has caused any serious damage. In country districts the advantages of the machines are found to be very great and, in fact, to make it possible to do work which would otherwise be considered prohibitive in cost.

A trenching machine of small size, and costing about £1100, will cut a trench 12 in. to 21 in. wide at the rate of 1 ft. to 9 ft. per minute. That machines of this type can be very useful in large towns will be fairly evident when I state that the Chief Engineer of the Chicago gas undertaking specially drew my attention to them as among their most useful appliances for speeding-up and cheapening their distribution work. I also saw one doing excellent work in Toronto.

USES FOR GAS.

Except that gas is much less used for lighting and for gas fires than is the case here, there is little noticeable change. The cookers appear to be good and efficient; but the water heaters, of which very large numbers are used, are, I should say, speedy and convenient in operation, but inefficient compared with the British apparatus. Gas is now used, not yet very largely, for central heating; and it is expected that this in time will account for an enormous consumption, as the American likes a warm house. Industrial uses are accounting for large sales of gas; and it would appear to me that there is good scope for the pooling of knowledge on this question, as in both countries much good work is being done in the design of these furnaces, and the industrial use of gas is expected to grow enormously.

PRICE OF GAS AND METHODS OF CHARGE.

A great deal of attention is given to methods of charging for gas, or "rate structures" as these are called in the United States. The fact is that where this question has been closely studied and analyses of costs carefully apportioned, as has been done in countless instances in America, it has invariably been found that the profits derived from selling gas on a flat rate, as in England, are entirely provided by a comparatively small minority of the consumers. This may seem surprising; but there is undoubted evidence to prove that it is the actual state of affairs. A paper by Mr. E. Haase, of Milwaukee (Wisconsin), discusses the details of costs, which he has apportioned under the headings of:

(*a*) Customer costs.
(*b*) Manufacturing demand costs.
(*c*) Distribution demand costs.
(*d*) Commodity costs.

I do not propose to go into details; but I would state that the conclusion arrived at was that, to apportion costs fairly, and yet be in receipt of the same revenue as derived with a flat rate, it was necessary to charge each consumer on the following basis:

Customers' costs	**$11.34, or 47s. 3d., per annum per customer.**
Manufacturing demands costs . .	**$4.30, or 17s. 11d., per annum per 100 c.ft. of 24-hour demand.**
Distribution demand costs . . .	**$30.54, or 127s. 3d., per annum per 100 c.ft. of hourly demand.**
Commodity costs	**$0.50, or 2s. 1d., per 1000 c.ft.**

These charges corresponded with a flat rate of $1, or 4s. 2d., per 1000 c.ft. It will thus be seen that the consumer, after paying for his standing charges, could purchase his gas at half-price.

In the paper a comparison is made between two classes of consumer. The first is a customer who heats his house by gas exclusively and used gas in the winter only; the second is a small restaurant. Both use the same amount of gas per annum; but while the first would pay $1.14, or 4s. 9d., per 1000 c.ft., the second would pay $0.80, or 3s. 4d.; the total annual revenue being the same under either system.

The object of this method of charging is, of course, to saddle each consumer with the full charges for supplying him, no more and no less, and to encourage such uses for gas as will employ the plant to the best advantage, and will eventually cheapen the cost of gas to the whole community. It is pointed out in the paper that some of the smallest and most unprofitable consumers are well-to-do people; and these gain an advantage at the expense of the poor but regular users of gas.

However, while much effort is being expended in getting these rate structures sanctioned by public authorities, not 10 p.ct. of gas undertakings are yet charging for gas on such a basis; while some of these have only been able to introduce it for industrial gas, which in the United States is a much wider term than in England, and includes gas used for business purposes. But this comparative non-success in introducing this system is no indication of the keen desire on the part of the American gas engineer and administrator to introduce a more scientific system of charging for gas. Many of them consider it of fundamental importance.

However, in the great majority of cases it is the custom to impose a minimum charge per month whether gas has or has not been used; and this is recognized as a first step towards a more equitable system. This minimum charge usually amounts to about an average of $1 (4s. 2d.) per month per consumer, and is based upon calculations of the cost of capital charges, depreciation, and taxes, arising out of fitting-up a consumer with a gas supply, *plus* the cost of meter reading, book-keeping, and the rendering of accounts per consumer. Of course, the payment of such minimum charges increases the revenue and reduces the price of gas charged.

It is not necessary for me to remind you of the numerous cases in which electricity users obtain stand-by gas services at the cost of paying gas meter rental only. Under the minimum charge system, all such consumers would pay something to cover the out-of-pocket costs of the gas company; while under the demand rate system the charge would be commensurate with the service obtained.

SUPPLY OF GAS AND ELECTRICITY BY THE SAME UNDERTAKING.

In the United States and Canada there are numerous cases of the same undertaking supplying both gas and electricity. The number of such probably exceeds 300. I have not been able to ascertain the approximately correct number. It has become recognized that it is for the general benefit of the community to place the supply of the two commodities under the same control, and so avoid the considerable duplication of costs in running two separate organizations. So much so is this the case that such combinations are now not resisted by the authorities or the public; and I found that in discussing this question with those in charge of the combined supplies, it was argued that the advantages of combination were so great that any possible disadvantages due to the suppression of competition could be but small in comparison.

This paper is already far too long, and while there is much else which was of great interest to me during my visit, time will not permit of any further descriptions being given, and, besides, I am afraid I may have wearied you as it is. I take this opportunity of acknowledging the extreme kindness of many of my American friends who have made it possible for me to show you illustrations and give descriptions of some of their methods.

Discussion.

The PRESIDENT said the paper had been full of fascination; and it ought to justify them all in immediately approaching their particular Directors with the suggestion that it would be a very good investment to send each of them to America to pick up new ideas.

COAL GRABBING.

Mr. C. VALON BENNETT (Rochester) asked whether grabs for grabbing coal from heaps were operated from a distance, or whether they were automatic. It always seemed a pity to him that a grab was not available which could be worked automatically. If the coal was stored away from the works by means of an aerial ropeway, the difficulty was in picking it up again, if it was spread over a large area.

Mr. GILL replied that the grab to which he had referred was operated from a distance by hand; it was not automatic.

RUBBER BELTS FOR COKE.

Mr. A. E. BROADBERRY (Buckhurst Hill) wished to thank Mr. Gill very much for his paper. It was now over five years since he (the speaker) was in America, and at that time the construction of the big gas-works coke oven plant at Chicago was just being started. He certainly thought the suggestion of the President that they should all apply to their Directors for permission to go out to the States, was a very good one indeed. He thoroughly enjoyed his own visit; and he was sure his Company had benefited from it since his return. Some mention had been made of rubber belts for coke. One of the first things he did on his return from America was to alter the bucket conveyor, which was constantly giving trouble, to a rubber belt. This had worked now for upwards of four years, and there was practically no sign whatever of wear on the rubber belt itself. All that time it had been conveying coke to the water gas plant. A great deal did depend upon the shape and angle of the shoot delivering the coke on to the belt. If this shoot was not properly constructed, it would easily set up a lot of resistance, which would cause the coke to tear the belt to a certain extent; but by careful attention to details of this description, the American engineers had brought the rubber belt conveyor to a very high state of perfection. Should any of those present contemplate transporting coke from one place to another, they could not do better than adopt a rubber belt for the purpose.

OUTSIDE PRODUCERS.

Mr. J. S. THORMAN (Stratford), alluding to certain outside producers shown on the screen, said it would be interesting to know the calorific value of the gas and particularly the percentages of CO and hydrogen. He understood coke and breeze were used in the producers. Was any coal mixed with them? Could the author give the fuel consumption of these producers? He could quite understand why it was necessary to remove the dust from the gas before burning; but he could not see the reason for definitely cooling the gas, unless it was necessary for the removal of this dust.

GAS AND ELECTRICITY.

Mr. L. J. LANGFORD (Tunbridge Wells) said Mr. Gill had given huge figures for the growth of the gas business; but one heard that electrical power could be developed very cheaply there. The author's figures proved that gas was far more than holding its own against electrical competition, even in a country where current could be generated so cheaply.

GET OUTSIDE OUR INSULARITY.

The PRESIDENT said the paper was fascinating in many respects; but perhaps the particular aspect of it which was helpful was that it showed that other countries had other lines of thought. One could see this from the way in which engineering construction had developed. Thus it was very important that they should try to gather, as far as possible, the good points of practice abroad; and a paper such as this enabled them to do that. They could, however, do it still more satisfactorily by themselves visiting America; and this was a question he quite seriously thought they ought to consider. They ought to put it to their Boards that it would be in the best interests of the undertakings they served that they should get outside their insularity, and endeavour to find out what was best in the practice of other nations. Inasmuch as Mr. Gill had opened up that fresh vista of possibilities to them, they were indebted to him.

MR. GILL REPLIES.

Mr. GILL, replying to questions that had been put, said the calorific value of the producer gas to which he had referred was round about 130 B.Th.U. (gross). Its composition was good. The CO was approximately 28 p.ct., hydrogen 10 p.ct., and CO_2 something like 5 p.ct. At Rochester they were using a mixture of coke of from 1 in. downwards, with all the breeze in it as it came from the screens. There was a good deal of flexibility with regard to the kind of material that could be used; but in none of the plants he saw was coal added. The fuel consumption varied from 10 to 13 lbs. of this small coke and breeze mixed per 100 lbs. of coal carbonized. The reason for cooling the producer gas was to permit the employment of metal cocks in the coke ovens; these having been found much preferable to anything else. Mr. Langford had referred to gas and electricity. Both were being developed very rapidly in America, and they did not seem to interfere one with the other. There seemed to be less talk about competition between the two there than there was in this country. It was recognized that, generally speaking, electricity had a use for light and power, and gas for any form of heat. These were the broad lines on which those undertakings that supplied both commodities went about it. Gas was developing remarkably. At Baltimore (which was about the size of Birmingham), where one Company supplied both gas and electricity, they were getting increases in some years of about 25 p.ct. in the sale of gas, and at the same time electricity was going ahead wonderfully fast.

As to the suitability of coke ovens for making town gas, he had no doubts himself; and he agreed with what had been done in Chicago in this way—and now in New York, where they were putting in an installation to make 20 million c.ft. a day of gas in coke ovens; this being in their view the best type of plant for their conditions. Coke ovens such as he had seen in the States worked so well, and were making such good gas, that he could see nothing wrong with them as gas-making units. Those of them who had read the paper of the Woodall-Duckham Research Staff, in the recent Coke Competition, would have seen there some very interesting information with regard to making a free-burning coke in ovens. Apparently it was a question of blending; and this opened up great possibilities of using ovens as "another string to their bow." These ovens were all being adapted for steaming; and many were steaming the charges. The ovens lent themselves to steaming in a way which verticals did, but which horizontals did not. He had been only too pleased to present his paper; and if members could, as Mr. Moon had suggested, get permission to go to America, he was sure they would enjoy the experience as much as he had enjoyed his two visits.

HOW TO OWN AND EQUIP A HOUSE.*

This book, on a very live subject at the present time, has been written by a number of different persons, each of whom can lay claim to expert knowledge in his own line, and has been compiled into a compact little volume by the publishers. It can be said at once that the work is well done, and—what is specially interesting to gas people—it deals in a thoroughly adequate manner with gas appliances and their special province in the home.

The book is divided into 16 chapters, and starts with methods of finding the money, and compares the terms usually offered by public authorities, building societies, banks, and insurance companies. It explains the true significance of the various Acts of Parliament, and how these have facilitated the steps to be taken by the prospective owner. This is a particularly good chapter. The volume then goes on to deal with such subjects as choosing the site and building a new house, and gives plans and photographs of various types of houses.

Furnishing the house is treated in an interesting manner, and is full of ideas for those who have to deal with this matter—in fact, the same can be said of the thoroughness with which all the other requirements of a house are discussed in this useful little book.

"Lighting, Heating, and Cooking" is the title of Chapter 2; and here this subject is treated in a knowledgeable way, with sensible arguments put forward for the use of the various methods of providing light and heat in the house. Under the heading of "Gas Lighting," the causes of blackening of ceilings, the value of warmth from gas lighting, the use of switches, and the importance of maintenance are all discussed; and gas lighting is at any rate given its due. As readers of the "JOURNAL" know full well, it can be quite satisfactory if common-sense is applied to its use; and this is adequately explained. Gas heating receives its full due, and as stated in this book, "the up-to-date gas fire, properly fitted, is as healthy a mode of heating a room as it is possible to obtain." The comparative costs of coal and gas fires, based upon the researches of E. D. Simon and M. Fishenden, is included, and arguments are deduced to indicate where and when it is more economical to use a gas fire. Water heating by gas is adequately explained, and sensible recommendations are made. The same can be said of cooking by gas. An illustration is shown in which a coke-heated boiler and a gas cooking range are seen side by side in the kitchen. At the same time full credit is given to electricity for its various uses; and throughout a fair balance is struck between the different methods which can be adopted in the new home.

Labour-saving devices and sanitary fittings receive full attention, and many arrangements not generally known are described in a manner which should prove most useful.

The book concludes with information in regard to making a garden, and insurance; and these chapters also maintain the general standard of excellence noted throughout. The volume is well got up, clearly printed, and well written. It contains no less than 355 pages; and while its price (2s. 6d.) is cheap, its value in information to the many interested in this subject—and who are not?—is decidedly great.

* "How to Own and Equip a House." London: R. A. Bateman, Ltd. Kingsway House, Kingsway, W.C. 2. Price 2s. 6d.

Smoke Abatement in Salt Lake City.—With the permission of the Salt Lake City Corporation Engineering Department, the Smoke Abatement League of Great Britain have issued in pamphlet form information from official reports on smoke abatement in the city named. As the result of the fight which has been for some time past waged against the smoke nuisance, it is said that the total reduction in the smoke produced in the industrial and business districts of the city amounts to 95 p.ct. of that produced at the time when investigation of the subject was started in the winter of 1919-20. The work of supervising the operation of residence-heating plants seems at the present time, for local reasons, to be in abeyance. The main objects of the League in producing the pamphlet are to render easily available a description of actual smoke abatement, and to exemplify what can be done if there exists a spirit of determination and co-operation, instead of one of apathy or even opposition. It would appear that at the time the campaign was started the quantity of coke consumed in the city was only 3470 tons a year for residences, and about 6000 tons in the plant of the Utah Gas and Coke Company; the remainder being disposed of outside.

FLAME SPECTRA OF CARBON MONOXIDE AND WATER GAS.

We desire to direct attention to two papers recently published in the "Proceedings of the Royal Society"—A. Vol. 109 (1925), pp. 176-186 and 523-526—by Mr. F. R. WESTON, B.Sc., D.I.C., embodying the results of researches into the flame spectra of carbon monoxide, hydrogen, water gas, &c., which he has conducted at the Imperial College of Science and Technology, under the joint supervision of Profs. W. A. Bone, F.R.S., and A. Fowler, F.R.S. The object of the researches was to elucidate certain aspects of the combustion of carbon monoxide, and notably whether or not this gas interacts *directly* with oxygen in flames—a point which has been much disputed among chemists during the past forty years, but which now seems to be in the way of being definitely cleared up by the spectroscope. The papers in question are of outstanding interest to everyone who, in one way or other, has to do with the question of radiation from flames, as well as to the chemist who is seeking further light on the mechanism of CO combustion. Also, the fact that Mr. Weston is the first holder of the Gas Research Fellowship which the Gas Light and Coke Company established two years ago in connection with the Department of Chemical Technology in the Imperial College of Science and Technology, gives the papers an added interest to readers of the "JOURNAL."

The spectrum of a flame of undiluted carbon monoxide burning in air (or oxygen) at atmospheric pressure is shown to consist of a banded radiation, extending from 5000 A.U. in the visible region to 2200 Å.U. far in the ultra-violet, upon which a continuous spectrum is superimposed. Both the banded and continuous parts of the spectrum, which are associated with the characteristic colour and actinic properties of a carbon monoxide flame, are due to *direct* interactions between carbon monoxide and oxygen molecules in the flame, without any intervention of steam. At the same time, unless both the carbon monoxide and oxygen are previously dried before combustion, the spectrum shows some characteristic "steam lines," which are due to interactions between CO and OH_2 molecules in the flame, which proceed simultaneously with, and independently of, the CO and O_2 interactions. As the carbon monoxide in the burning gas was progressively replaced by hydrogen, both the banded and continuous parts of the spectrum rapidly faded away, until with an equimolecular—*i.e.*, 50 CO+50 H_2 by volume—mixture of the two combustible gases ("water gas") only "steam lines" remained visible in the spectrum; the characteristic CO radiation and flame-colour having almost entirely disappeared. When a flame of undiluted CO was burnt (undried) in oxygen under reduced pressure, the banded part of the spectrum became more distinct and the continuous part less intense as the pressure was diminished; the "steam lines" were invariably present in the spectrograms. When a flame of carbon monoxide, previously dried by passage through strong sulphuric acid, was burnt at atmospheric pressure in oxygen, similarly dried, the "steam lines" in the resulting spectra had almost disappeared (they were only faintly visible), whereas the intensity of the continuous part of the spectrum remained undiminished.

The conclusion drawn from the experiments is that, in the flame of pure (undried) carbon monoxide, two sets of independent interactions occur simultaneously—namely: (*a*) Direct interactions between carbon monoxide and oxygen, exciting radiations which give rise to the continuous and banded parts of the spectrum, and to the characteristic blue colour of the flame; and (*b*) interactions between CO and OH_2 molecules, which originate the "steam lines" in the spectrum. When hydrogen is gradually added to the burning gas, the relative proportions of the first-named interactions diminish rather rapidly, and proportionately more of the CO is burnt by interaction with OH_2 molecules, until, when an equimolecular mixture of carbon monoxide and hydrogen is reached, the CO-steam interactions occur to the practical exclusion of the CO-oxygen interactions. And it may be said that these experiments have afforded the first clear evidence that in an ordinary CO flame both sets of interactions are going on independently and simultaneously.

Woodall-Duckham Continuous Verticals.

The Gas Light and Coke Company have placed a contract with the Woodall-Duckham Vertical Retort & Oven Construction Company (1920), Ltd., for an installation of "W.-D." continuous vertical retorts at their Bow Common Station, having a capacity of 8 million c.ft. of gas per diem. The installation will include duplicate coal and coke conveyors, and will be fitted with "W.-D." waste-heat boilers. The United Gas Improvement Company have also placed an order for a second installation of Woodall-Duckham vertical retorts for their Meriden Works, U.S.A. An order for a second installation of Woodall-Duckham vertical retorts has also been placed for Holyoke, Massachusetts, having a carbonizing capacity of 120 tons of coal per day.

STUDIES UPON CATALYTIC COMBUSTION.

Part I.—The Union of Carbon Monoxide and Oxygen in Contact with a Gold Surface.

By WILLIAM A. BONE, D.Sc., F.R.S., and G. W. ANDREW, M.Sc.

This paper, which appears in the current issue of the "Proceedings of the Royal Society," is the first of a new series in which the scientific researches of Prof. Bone and his various collaborators at Manchester University, the University of Leeds, and the Imperial College of Science and Technology, London, upon the subject of catalytic combustion, will be described. It is explained that the delay in publishing them has not been disadvantageous, because it has allowed the authors to test experimentally some recent theoretical developments of the subject, and more particularly that due to Langmuir, who, in 1916, published his well-known views concerning the chemical action of surfaces, in which he developed further the basic views originally put forward by Bone and Wheeler ten years earlier.

In reviewing the present state of the subject, the authors remark that their experiments have shown that catalytic combustion at ordinary pressures probably involves deeply occluded gases, as well as much adsorbed monomolecular films at the surface, and that the mechanism of the process is more complex than the Langmuir school suppose. Indeed, it seems to them hazardous to base (as Langmuir did) a general theory of catalytic combustion solely, or even principally, upon experiments at such exceedingly low pressures as he employed, because it by no means follows that the order of things will be just the same at pressures of several hundreds of millimetres as it is at 0·1 millimetre.

After describing the details of their own experiments upon the action of a gold surface in inducing the combination of carbon monoxide and oxygen at temperatures of *circa* 300° C., the authors summarized their conclusions thereon as follows:

(1) The rate of combination of a (moist) theoretical mixture of carbon monoxide and oxygen ($2CO+O_2$) in contact with a gold surface in a "normal" state of activity at 300° C., or thereabouts, is always directly proportional to the pressure of the nitrogen-free mixture.

(2) The "normal" catalyzing power of the surface at such temperature may be greatly diminished by either (i.) cooling it down to, and keeping it for some time at, the ordinary room temperature; or (ii.) prolonged evacuation of it without any such cooling.

(3) The re-attainment of "normal" activity by a surface whose catalyzing power has been enfeebled by such treatments as the aforesaid is a slow process, usually extending over many hours.

(4) The catalyzing power of the surface, when in "normal" activity, can be highly stimulated by previous exposure to either carbon monoxide or oxygen at the said experimental temperature. In neither case, however, was the full extent of such stimulus immediately manifested when the stimulating gas was rapidly removed and a fresh charge of the reacting mixture ($2CO+O_2$) re-introduced into the apparatus.

(5) Whenever, starting with the surface in a state of "normal" activity, either of the two reacting gases was originally present in excess, the subsequent rate of combination, which rapidly became super-normal, was always proportional to the partial pressure of the carbon monoxide, which thus became the controlling factor in such an experiment.

(6) Although the catalytic combustion was subsequently found to depend on the presence of moisture in the system, no hydrogen was ever detected in the reacting gases, even when a large excess of carbon monoxide was present.

(7) A microscopic examination of the gold surface at the conclusion of the experiments failed to reveal any signs of "pitting" having occurred; on the contrary, neither the lustre nor the smoothness of the metal seemed to have suffered any diminution.

The authors finally say that, in their opinion, such results are best explained on the supposition of an "activation" of *both* of the combining gases by association with the surface, and that such activation was by no means confined to superficially adsorbed gas-films of monomolecular thickness, but extended also to more deeply occluded gases. They also suggest that structural changes in the metal itself, or maybe such changes in conjunction with deeply occluded gas, play an important part in the phenomena.

Vegetable Pulp as a Binder.—On Thursday last a paper on "Binders for Briquetting" was read by C. J. Goodwin, M.I.Chem.E., and Dr. G. N. White at a meeting of the South Wales Institute of Engineers. The authors described the results obtained at the Cambrian Patent Fuel Works using vegetable pulp binder. It had been demonstrated, they said, that pulp binder ovoids made from anthracite coal burned smokelessly and efficiently in a closed stove and on an open grate. Pulp, however, would never be a complete substitute for pitch.

NEW VERTICAL RETORT INSTALLATION AT PLYMOUTH.

The new installation of Glover-West vertical retorts at the works of the Plymouth and Stonehouse Gas Light and Coke Company was inaugurated at Plymouth last week with fitting ceremony and in the presence of a large company of gas engineers, members, and officials of the Plymouth Corporation, and Directors and Officials of the Company.

The party were conducted over the new installation by the Engineer (Mr. P. S. Hoyte) and Officials of the Gas Company, and by members of the contracting firm, West's Gas Improvement Company, including Alderman Fred West (ex-Lord Mayor of Manchester) and Mr. Frank West.

DESCRIPTION OF WORKS.

No. 2 retort house was originally occupied by an installation of inclined retorts. These have been removed, and the building has been adapted to the installation of 72 Glover-West vertical retorts of the 33 in. new model, capable of an output of 4 million c. ft. of gas per day.

The coals carbonized at Plymouth are generally sea-borne from the Durham coalfields; and the demonstrated suitability of the Glover-West verticals for dealing with this class of coal was one of the main considerations which led to their adoption. No doubt the success of this type of vertical retort with coals usually admitted to be difficult to carbonize is due to the essential features of the design. These may be classified as follows:

The Retort.—(*a*) The elliptical shape of the sectional plan of the retort gives it a natural rigidity, due to the arch-like shape of the retort walls.

(*b*) No stays being required, the whole superficial area of the sides of the retort is in immediate contact with the flame of combustion; and loss of heat from absorption by excessive brickwork is avoided.

(*c*) The ends of the elliptical retort in plan are in the form of a curve continuous with that of the sides. There are thus no sharp corners across which the charge might "bridge" or "arch over." All classes of coal, therefore, pass evenly down the retort without sticking or hanging-up.

(*d*) Graphite or scurf forming in the retort remains in close contact with the curved retort walls, and does not flake away and cause stoppages or hanging-up.

(*e*) The new model retort with the steaming chamber, or "bell-bottom," possesses two advantages:

1. It opens up the core of coke, presenting a large surface to the action of steam, by means of which water gas is generated in the base of the retort, without interfering with carbonization proper taking place in the upper portion of the retort.

2. It increases the flexibility of the unit by facilitating the action of the coke extractor, the speed of which can be more readily varied to suit the speed of carbonization.

The Coke Extractor.—The full weight of the charge is taken by the coke extractor, which is in the form of a helical inclined plane continuously and regularly withdrawn from the charge, so that the coke is lowered into the receiving chamber without breakage.

The Setting.—(*a*) The combustion chambers are arranged horizontally across the lines of the retorts.

(*b*) A combination of double secondary-air inlets with the internal waste-gas uptake ensures equal heating of all retorts.

(*c*) The temperature distribution is not fixed in relation to each retort, but can be readily varied over the whole vertical length of the retort, to suit the class of coal being carbonized; the maximum temperature may be in the upper portion or the lower portion of the retort, or the temperature may be evenly distributed over the whole length of the retort.

(*d*) The secondary air rising in the outer wall of the setting adjacent to the internal passage of the products of combustion is a combination giving regeneration with insulation.

(*e*) The Glover-West system of heating rendered possible the facility of the Glover-West retort for steaming purposes. Reference may be made to several sets of investigations carried out by the Fuel Research Board and the Gas Investigation Committee of the Institution of Gas Engineers, whose published reports are in the hands of all students of carbonization.

The Producer.—(*a*) The Glover-West producer built in the setting is of the step-grate type, left open to the atmosphere, so that the ingress of primary air is controlled solely by the demands of the setting as expressed by the chimney pull. The producer gas is kept constant in quantity and quality.

(*b*) It is specially designed so that the position of the grate relative to the outlet of the producer gas is correctly determined.

(*c*) It is only necessary to remove ash every 8 hours, or at longer intervals when the ash is favourable.

Retort Accessories.—(*a*) Each retort is a separate unit from the point of view of coal supply, coke discharge, and gas take-off.

(*b*) The coal valve is simple in construction, rotary in action, and operated by one motion of a lever.

(*c*) The top mouthpiece is so constructed that the whole cross-sectional area of the retort is open to inspection, for which purpose spherical covers are provided.

(*d*) The internal division plate keeps the gas outlet separate from the coal inlet, avoiding saturation of the coal by condensates, and consequent sticking of the charge.

(*e*) The gas off-take valve is a simple plate valve with only one moving part; there are no working surfaces exposed to the gas.

(*f*) The gas rises straight from the top of the retort to a gas-collecting main placed high above the retort bench, so that the primary condensates do not suffer distillation by the heat of the retort bench.

(*g*) The West-Taylor patent steam valve provides a means of regulating the supply of steam to each individual retort in relation to the temperature of the retort, the rate of carbonization, and the quality of gas which it is desired to produce.

WASTE-HEAT RECOVERY.

The retort bench is equipped with two waste-heat boilers constructed on Kirke's patent by Messrs. Spencer-Bonecourt, on the induced-draught firetube principle. The waste gases from the retort settings are led into a common flue, and dampers are arranged so that either boiler can take gases from five of the nine settings. Each boiler is capable of evaporating 7000 lbs. of water per hour from and at 100° C. The steam from the boiler passes to a set of superheater tubes arranged for indirect heating in the inlet products box, each of which, together with the waste-gas flues, is lined with one layer of firebricks and one layer of insulating bricks.

In addition to the usual boiler fittings, each boiler is fitted with a "Thermofeed" regulator and a "Hilo" water-level alarm, manufactured by Messrs. Ronald Trist. This apparatus ensures that the water level in the boilers is kept constant, and automatically gives the alarm if for any accidental reason the water should stand too high or too low in the boilers, thus reducing to a minimum the amount of supervision which it is necessary to give to this portion of the plant.

The induced-draught fans are electrically driven and generously proportioned, provision being made for a 20 p.ct. continuous-rated volumetric overload. The impellers run in water-cooled bearings with double-ring lubricators. The feed pumps are two in number, of the Weir design, and are capable of supplying both boilers under full load. They take their supply from a tank with a capacity equivalent to two hours' evaporation, arranged in an overhead position in the retort house.

The boilers are supported on steel framework built as near as practicable to the retort settings, so that losses by radiation and infiltration of air are reduced to a minimum.

STEAM SUPPLY TO RETORTS.

Each retort is fitted with the West-Taylor patent steam-regulating valve, which is operated by a hand lever with a spring indicator engaging with serrations in the flange. There are ten serrations to one revolution; and as the valve orifice is designed so that the effective opening is proportionate to the angular movement of the lever, the number of serrations traversed—and these can be counted by listening for the "clicks"—is a measure of the area of opening, and, therefore, in conjunction with the other tabulated data, is an approximate measure of the quantity of steam supplied to the retort. Steam is supplied to the retorts at pressures ranging from 10 to 30 lbs. per sq. in., and two Auld's reducing valves are fitted. Two pressure gauges and two thermometers are fitted to the low-pressure steam range, and two large steam traps are provided as a precaution against water-hammer. All this apparatus is constructed of special metals, to withstand steam superheated to 250° C. The whole of the steam piping, as well as the boilers themselves, is thoroughly lagged to reduce heat losses to a minimum.

COAL SUPPLY.

When steamers are discharging at the wharf, coal is delivered direct to the vertical retort house; but at other times supplies are drawn from No. 1 retort house coal store, conveyed in steam wagons, and tipped into the receiving hopper of the elevator at the south-west corner of the vertical retort house, each load passing over a weighbridge. The coal from the receiving hopper passes by way of a reciprocating tray feeder to a short elevator with 20-in. buckets, which deliver it to a West double-roll coal breaker capable of breaking 40 tons of coal per hour and reducing it to less than 2 in. cube. The broken coal is elevated by another fixed-bucket elevator and delivered to the top strand of a West lip-bucket conveyor.

WEST LIP-BUCKET CONVEYORS.

The retort bench is encircled by two lines of the West lip-bucket conveyor, and the arrangement of these is one of the outstanding features of the installation.

Coke is discharged from the bottom retort mouthpieces, and directed by a light travelling shoot to either of two lines of steel feed-troughs, below which the lip-buckets run, suspended each on two lines of West's well-known renewable-bushed roller bearing chains. The buckets are of ample size, so that the coke is taken without breakage and without the necessity for any form of mechanical filler. The buckets proceed from the coke chambers up the gable-end wall of the retort-house, changing direction to the horizontal, and discharging coke on to a band

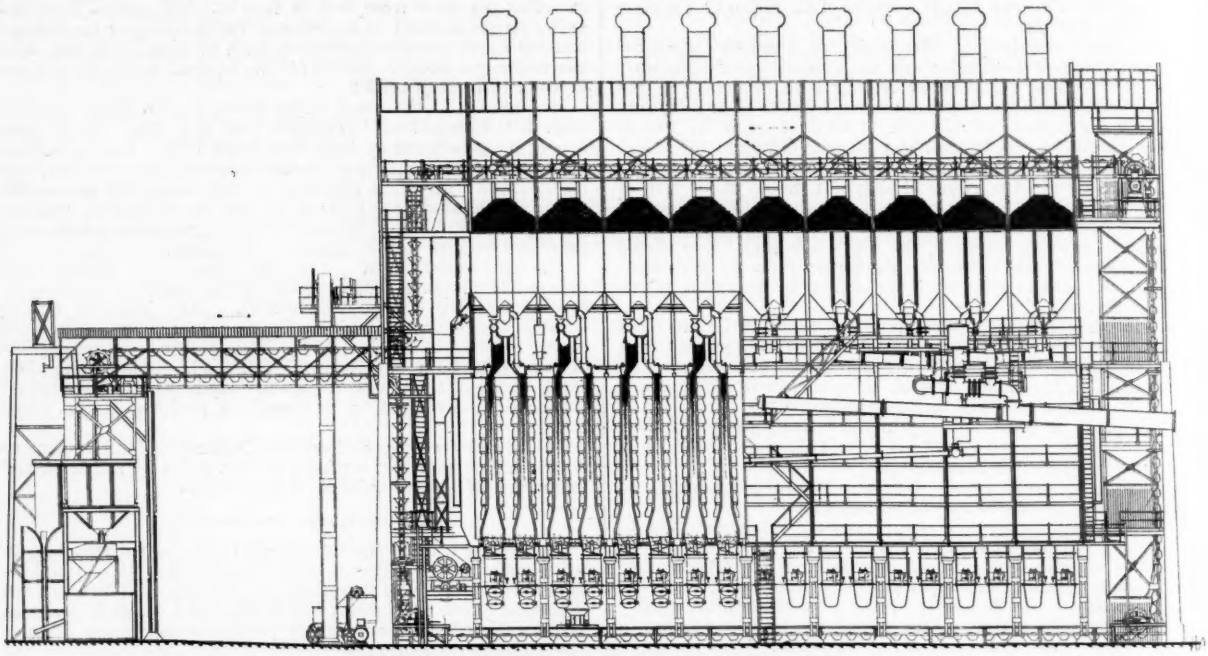
conveyor, by means of which it is distributed in the coke-storage hoppers or conveyed to the automatic skip-filler feeding the telpherage system. The same buckets then return to the retort house in a horizontal direction, receive the supply of coal, elevate it, and distribute it in the overhead bunkers of 48 hours' capacity supplying the retorts. Each lip-bucket conveyor is thus able to handle coal and coke at one and the same time without interference with either operation, and each is a complete stand-by to the other.

The West lip-bucket conveyor is the outcome of fifty years' experience in the handling of materials in gas-works, and it is particularly designed for service in which hard wear and tear is to be encountered during normal working conditions. Not only, therefore, is it designed specially to obviate the usual rotary filler which forms an integral part of the ordinary gravity-bucket conveyor—thus eliminating this fruitful source of coke breeze and dust—but particular pains have been taken in designing the chain, the rollers, and the pins to ensure a long working life with the minimum of renewals and repairs.

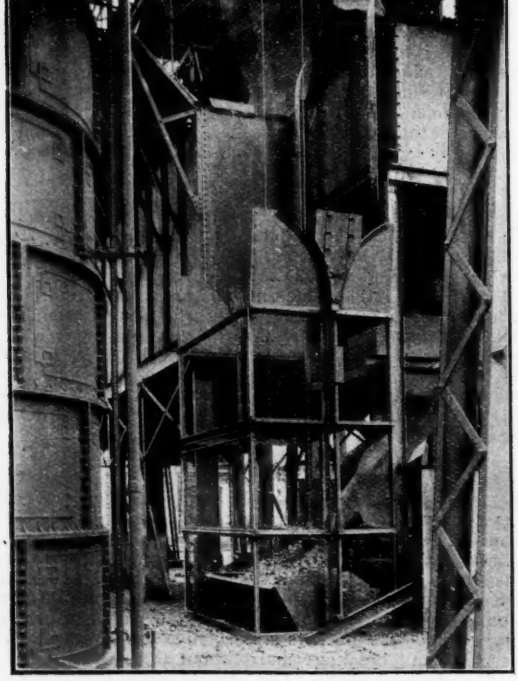
In the first place, there is no wear and tear on the links of the chain, as these do not move relative to the pins upon which they are mounted, except at a corner where the direction of the conveyor changes from (say) the horizontal to the vertical; the only movement of the links then being the quarter of a revolution necessitated by the change of direction of the conveyor. That is to say, beginning at a point below the retort bench, the link will revolve on the pin during its travel only once in the complete circuit which it makes before it arrives again at the starting point.

In the second place, each pin upon which the links and the rollers are mounted is encased by a cast-malleable renewable bush extending the full width of the rollers, so that no wear whatever occurs on the pin itself, but on the renewable bush encasing the pin; and this bush, when worn, can be readily removed by hand, and a new one fitted without any skilled labour being required.

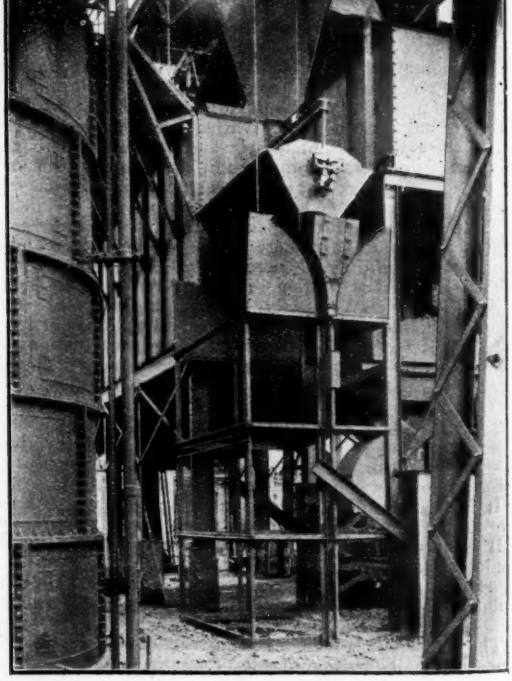
In the third place, the rollers are hollow cast, each being cored-out to form its own grease reservoir, so that each roller carries within itself its own lubrication. The grease is forced into the rollers by the grease gun provided with the plant; the pressure at which the grease is forced into the cavity of the roller being sufficient to squeeze out, and keep out, any coke



SECTIONAL DIAGRAM OF THE NEW INSTALLATION.



West Automatic Skip Filler in the Loading Position.



The Skip Entering the Guides.

dust or foreign matter which might otherwise work its way into the running parts.

It is interesting to note that the total length of this chain operating in, or projected for, gas-works in all parts of the world is over nine miles. It is the latest development of mechanical handling in gas-works which was initiated by the late Mr. John West at Maidstone over fifty years ago.

AUTOMATIC SKIP FILLER.

Coke is supplied to skips carried by a telpher machine by means of one of West's patent automatic skip fillers. The skip is lowered from the telpher machine within guides, and depresses by its own weight a system of levers which operate the doors of the coke hopper in such a manner that one skip-load flows out. When the full skip is raised, a counter-balance returns the doors to the original position. The machine attendant is thus able to take a supply of coke from the hoppers without assistance.

RETORT-HOUSE ACCESSORIES.

Coke for the producers is delivered to a storage hopper with capacity equal to twelve hours' supply by the retort-house conveyor, and fed, via an "Avery" automatic weighing and recording machine, to a suspended skip travelling on an overhead runway to the several producer charging doors.

An electrically-driven lift with push-button control is provided to give access to all the several platforms of the installations. The motor is capable of elevating a net load of 20 cwt. at a speed of 70 ft. per minute. The gates in the cage and in the lift tower are of the collapsible type, fitted with electric locks, so that the lift cannot be operated until all gates are closed. The gearing is self-sustaining, but automatically-controlled gear is provided to prevent the falling of the cage in the event of failure of the ropes, together with limit switches to prevent over-running, and a powerful electric mechanical brake.

The gas from the retorts passes into 18-in. dia. foul mains, which lead to two ranges of 24-in. mains, each equipped with an 18-in. Parkinson & Cowan retort-house governor; the whole being arranged to secure absolutely equal pressure conditions on all retorts. Pressure indicators, of both the dead-beat and the **U**-tube type, are provided, as well as pressure recorders, on both sides of the retort-house governors.

All the electric motors on the installation are totally enclosed, dustproof, and watertight, and are of the "Lo-Thermo" design manufactured by Messrs. Electromotors, fitted with internal air circulation, with the exception of those for the lift and the boiler fans, which are specially designed.

The motor starters, switches, and all electric equipment were manufactured and supplied by the Gas Company.

While the visitors were in the booster house, there was a brief but interesting ceremony. In an informal manner Alderman WEST handed Mr. J. H. Ellis, Chairman of the Company, a handsome silver salver as a souvenir of the occasion, and in recognition of the cordial relations which had existed between West's Gas Improvement Company and the Plymouth Gas Company.

Mr. ELLIS suitably returned thanks.

Following the inspection a luncheon was held at the Royal Hotel—Mr. ELLIS presiding.

The CHAIRMAN, proposing "Success to our new installation of vertical retorts," coupled the names of Alderman Fred West and Mr. P. S. Hoyte, who, in collaboration with Mr. West, had designed the retort house and supervised the work. West's Gas Improvement Company, said Mr. Ellis, was founded by the late Mr. John West at Maidstone in 1874, and the firm, with branches in America and Australia, celebrated their jubilee last year. The success of the new installation was assured. So far they knew it was saving them a large amount of coal; and they believed that, when a few minor adjustments had been made, they would have an installation of the greatest benefit to Plymouth. It would be a big saving for them if the contractors maintained the terms of their contract, as he had no doubt they would. The workmanship, he was told, was of the best, as also was the material; and every promise which had been made to them had been kept. Mr. West had recently filled the position of Lord Mayor of Manchester; and they knew that in fulfilling those civic duties he had the knowledge of affairs and of men which was needed to make a good Lord Mayor. Mr. Hoyte had been connected with the Plymouth Gas Company for a long time; and they all knew that the supervision of the work was in good hands.

Alderman WEST, responding, said it was a great pleasure, after his wonderful experience of the past twelve months, to resume his normal activities, and to take part in the inauguration of that installation. He did not think the public realized to what extent engineering entered into the gas industry, and what a wide scope in engineering was covered by the gas engineer. If they took the plant they had just seen, they would find in it almost every phase of engineering they could conceive. The gas industry had been such a faithful servant of the public for over a hundred years that many were apt to underestimate its importance in the life of the community. The amount of gas manufactured had increased enormously in recent years; and in spite of a period of acute trade depression the gas sold had increased at least 10 p.ct. in 1922, and 7 p.ct. in 1923. These facts were eloquent testimony against the view that the gas industry was decaying. Gas, he suggested, was the key to the solution of fundamental problems with which the country was concerned; the smoke problem being an example. Gas and coke were the most effective means of distributing the heat value in coal. The time would come when every house would be supplied with gas fires and cookers. In addition carbonization provided such valuable commodities as oils and dyes, and large quantities of ammonia for fertilizer purposes. The Directors of the Plymouth Gas Company need have no anxiety as to the future. In installing the new retorts, there had been collaboration between the Engineer and themselves. Success depended upon collaboration; and with the long association they had had with Mr. Hoyte they felt there was an understanding between contractor and user which would bring good to themselves and help to fulfil their obligations. That day's ceremony suggested that the courage and commercial enterprise which the Plymouth Gas Company had always shown would reap the due reward, which would be reflected in dividends to the shareholders and cheaper gas to the consumers. He trusted the Company would for many years continue to enjoy the Chairmanship of Mr. Ellis.

Mr. HOYTE, also responding, referred to the fact that he was a fellow pupil with Mr. Frank West, and that the late Mr. John West was at one time Consulting Engineer to the Plymouth Gas Company. The firm of West had prospered on its merits. To his mind there was in the whole industry no more happily named firm than West's Gas Improvement Company. They were always improving. He had seen the work of the staff from top to bottom, and he believed the position the firm occupied in the industry to-day was due to the way they did their work and selected their men to do it. As regards the installation, the duties of the staff of the Plymouth Company were just commencing. He had every confidence that Messrs. West would fulfil their guarantees; and his next duty and that of his staff would be to maintain the results they had achieved, and, if possible, surpass them. He had received splendid assistance from top to bottom, and his staff, Messrs. Clark, Widlake, and Walters—a very fine foreman—had stood by him admirably. He believed all concerned had made a good job of the installation; and on behalf of his staff he had to thank the Chairman and his colleagues of the directorate for their active assistance and encouragement. Mr. Ellis said he had not a technical mind, but he (the speaker) knew of no man who could pick up a technical point more quickly. They had spent the shareholders' money, and they were going to give them more than change for their shares; and the recent purchasers of stock would have good reason to be satisfied with their confidence in the undertaking. They had a gas-works, distribution depôt, and organization of which they might well be proud.

The toast of "Our Guests" was proposed by Mr. T. GREEK WILLS, the oldest of the Directors, and replied to by the MAYOR of PLYMOUTH.

SAFETY IN MINES RESEARCH BOARD.

A report by the Explosives in Mines Research Committee on "Electrical Exploders for Shot-Firing in Coal Mines" has just been published by the Safety in Mines Research Board. (Safety in Mines Research Board Paper No. 11; H.M. Stationery Office, Adastral House, Kingsway, London, price 1s. net.) The use in coal mines of permitted explosives, which are of the type of high explosives, requires the employment of a detonator which, according to present practice, is fired by a magneto exploder. For safety and efficiency the magneto exploder must be incapable of igniting firedamp, but must be fully capable of igniting the detonator. The problems discussed in the present report are those of devising safe and reliable exploders which will fulfil these conditions, or alternative means of providing the current necessary to actuate detonators. The investigation has shown that existing electric exploders, when properly made, are well suited for igniting both high-tension and low-tension fuseheads, both singly and in series of two. It has also shown that they can readily be made safe in the presence of firedamp by several methods. The two which appear to be the best have been examined in detail. Of these the Committee prefer that which provides a suitable short-circuit path (such as a broad band of copper of suitable thickness) next to the armature core. As regards the alternative problem—namely, of suggesting means, other than magneto exploders, of providing the current necessary to actuate detonators—an account is given, for the first time, of work carried out at the Home Office Experimental Station, Eskmeals, during 1913-14. It is concluded that dry batteries, provided they are maintained in good condition, are satisfactory for low-tension fusehead ignition. Regarding high-tension fuseheads, a new form of shot-firing apparatus, consisting of a single winding and a single dry battery, has been developed, and found to be safe and satisfactory.

Coke Oven Gas for Steel Works.—In his presidential address to the Cleveland Institution of Engineers at Middlesbrough on Nov. 16, Mr. Arthur Dorman, Managing Director of Messrs. Dorman, Long, & Co., Ltd., referred to the fuel economies effected in iron and steel works practice in recent years. In 1916, he said, his firm began using coke oven gas with ordinary producer gas for fuel purposes, and they had succeeded in reducing the consumption of coal by 42 p.ct. They had now had sufficient experience with coke oven and blast furnace gases to assert that these had no deleterious effect upon the quality of the product. They were impressed by the economies promised by these gases; and as soon as opportunity offered, they were determined to make strides in this direction, the idea being to make surplus gases the sole fuel not only for the smelting of steel, but for the heating of ingots in the smoking pits, and for raising power, so making it possible for steel works and rolling mills to be run without using a pound of coal directly for that purpose.

COAL ASH AND CLEAN COAL.

By R. LESSING, Ph.D., F.C.S., M.I.Chem.E., Consulting Chemist and Hon. Secretary of the Coal Research Club.

Abstract from Lecture I.—Nov. 23, 1925.

The lecturer expressed a feeling of apprehension in introducing a subject dealing with so worthless a material as coal ash—particularly as the part of the lectures dealing with the second half of the title, "clean coal," would require only a small fraction of the allotted time for a complete exposition of the knowledge concerning it. Nevertheless, the valueless impurities in coal deserve closer attention than they have received in the past, and their study is indissolubly bound up with the investigation of the true coal substance and, indeed, with the great coal problem itself, on which our present system of civilization is based.

ECONOMIC SIGNIFICANCE OF THE MINERAL CONSTITUENTS.

As an example of the bearing which mineral constituents of coal have on the economics of the fuel requirements of Great Britain, Dr. Lessing referred to his estimate of the cost of railway carriage of incombustible material from the collieries to the consumer, as recently submitted to the Royal Commission on the Coal Industry. With an average length of haul by railway companies of 43 miles at a mean cost of 3s. 8d. per ton, approximately £4,500,000 is spent per annum on material which is worse than useless, since probably more than double this amount is expended in the collection and disposal of the ashes from the place of consumption to their final resting place. The consequential losses from lowering the combustion and carbonizing efficiencies can hardly be estimated with any degree of accuracy, but they again will be a multiple of the figure quoted. The country's non-productive expenditure on this score may therefore be safely put at the stupendous figure of from £10,000,000 to £20,000,000—a waste which surely should be a worthy subject for the closest scientific, technical, and economic examination.

INFLUENCE OF INORGANIC COMPOUNDS ON THE FORMATION OF COAL.

To comprehend the full significance of the mineral constituents and companions of coal, the manner and conditions of its formation should be constantly kept in mind. The principal differences between various kinds of coal are due to (1) the kind of vegetable raw material from which they were formed, (2) the conditions under which this material was accumulated, (3) the agencies by which it was decayed, and (4) finally the stage at which these biological, chemical, and physical processes came to a standstill, or—more strictly speaking, and recognizing the never-ceasing activities of Nature—the stage at which these changes have arrived in our geological era.

These four groups of factors involved in determining the formation, structure, and constitution of coal are each and all influenced by the nature of the inorganic compounds with which the organic material is associated or in contact.

INORGANIC PLANT CONSTITUENTS.

In the first place must be mentioned the inorganic constituents of the plant substance, although, as will be seen later, this source is quantitatively the least important. The consideration of that portion of coal "ash" contributed by the plant itself, involves a study of plant physiology and particularly plant metabolism, a subject the vastness and complexity of which does not permit of giving it here more than the most casual attention. The difficulties of interpreting the experimental results obtained from the examination of fossil coal are enhanced by the fact that we are dealing with a vegetation concerning the composition of which we can only speculate from analogy with modern plants and a vegetation the conversion of which into coal must have also affected its inorganic compounds.

"Essential and non-essential plant elements" provide a wide range of combinations; and complications arise from the differences in the ash content and composition of different kinds of plants, and different parts of a given plant. Thus the ash may vary from a fraction of 1 p.ct. in the wood to 20 p.ct. or more in the leaves; the living tissues being always higher in ash than the non-living. Further differences are introduced by seasonal and even diurnal variations, by the nature of the soil on which the plant grows, its age, the effect of salts in water in the case of aquatic and marine plants, of sunlight or shade, and many other factors, difficult enough to elucidate by experiments with modern plants, but almost too complex to unravel from the mixture of vegetation decayed and transformed into what we know as coal. And yet the lecturer is convinced that the inorganic constituents of individual plant entities will form a useful guide in work on the constitution of coal, once methods are worked out for correlating them with the results from the analysis of the organic portion and the findings of microscopic examination.

A comparison of the ash from groups of coal components with the ash from lycopodia has already proved useful in deciding that the high alumina content of durain (dull coal) is not due to its derivation from lycopods, but to admixture of clay substance.

TABLE I.—*Banded Bituminous Coal.*

	Percentage in Ash.		
	Al_2O_3.	SiO_2.	$\frac{Al_2O_3}{SiO_2}$
L. chamaecypar, with spores (Aderholt)	51·85	13·60	3·81
" without spores (Aderholt)	57·36	12·96	4·43
L. clavatum (Aderholt)	26·65	13·94	1·91
" (Ritthausen)	39·07	18·82	2·11
" "	22·20	13·01	1·71
" (Church)	15·24	6·40	2·38
L. complanatum (Ritthausen)	37·87	10·06	3·76
L. alpinum (Church)	33·50	10·24	3·27
L. selago (Church)	7·29	2·53	2·88
Average ratio			2·92
"Mineral charcoal"—			
"Better Bed" (Thorpe)	33·8	38·7	0·87
"Haigh Moor" (Thorpe)	28·7	36·1	0·80
Fusain (Lessing)	8·66	8·84	0·98
Durain "	42·34	50·54	0·84
Clarain "	16·58	9·44	1·76
Vitrain "	15·49	6·08	2·55
Kaolinite (calcined) (Theory)	45·87	54·13	0·85

INORGANIC COMPOUNDS IN THE ACCUMULATION OF COAL-FORMING MATERIAL.

The accretion of the vegetable mass is subject to the influence of the conditions of accumulation. Material carried by, or laid down in, salt or brackish water covers itself with a salt solution which, after subsequent processes of evaporation or drying, leaves films of these salts upon the surface of the plant fragments, some of which will be retained by adsorption, even if a subsequent leaching out with fresh water should take place. Since the plant fragments are largely composed of colloidal substances, the electrolytes introduced with sea water cause coagulation to take place, which again tends to lock-up the dissolved salts of the reacting solutions. These phenomena must be regarded as among the sources of the sodium chloride content of many coals, which in practice appears as a destructive constituent, when, as in coke ovens or gas retorts, it is volatilized and attacks as a fluxing agent the refractory materials of which they are built.

The mineral detritus, mostly in the form of mud suspended in the water, became intermingled with the vegetable mass or settled on it; and where it was finely subdivided or in form of colloidal solutions, it percolated the magma with comparative ease, to be deposited by gravity or by coagulation where the chemical conditions permitted.

As in the adsorption or other retention of salts by the peat or coal magma, so in the removal therefrom of soluble salts, colloidal phenomena play an important part. This is particularly the case where, by the decay of the vegetable débris, soluble organic compounds of an acid character, such as ulmic acid, are formed; solutions containing these, on percolating through lower layers, leach out bases which are re-precipitated on continuing their downward path. In this manner a redistribution of certain inorganic compounds, notably iron and alumina, takes place—somewhat on the lines of the formation of hardpan, known to the agriculturist and forester.

In many respects the problems involved resemble those dealt with by the soil chemist, who is concerned with the first member of the chain leading from vegetable débris through peat, lignite, and brown coal to bituminous coal and finally anthracite.

The function of the inorganic accessories has not yet been studied in connection with the theories on the decay of raw material of coal and its degradation into a compact highly carbonaceous fuel. Whether the processes of coal formation were biological or chemical, it must, from analogies in fermentation practice and from experience with catalysts, be expected that the mineral ingredients had a very decided influence on the course of decomposition of the organic matter.

MINERAL MATTER IN COAL AFTER FORMATION.

The diversity of material and conditions involved in the formation of coal explains the difference in the structure, composition, and general properties of the world's coal deposits and of different parts of a given seam. There were, however, until recently comparatively few analyses on record of the ash of clearly defined constituents of coal. The separation by Stopes of four distinct ingredients from bituminous coal made it possible to inquire more closely into their mineral constituents. These coal components are: Fusain, the equivalent of "mother-of-coal" or "mineral charcoal;" durain, the dull hard coal; clarain, the portion of bright coal still containing plant débris; and vitrain, the bright coal of conchoidal fracture, originally thought to be without structure, but now known to have a definite, though largely obliterated, structure.

By the work of Stopes, Tideswell and Wheeler, Lessing, and a number of subsequent workers, the differences in the microstructure of these coal components were proved to be associated with characteristic differences in their chemical composition and properties, and notably in their behaviour on extraction with solvents, thermal decomposition, oxidation, and hydrogenation. In particular it was shown that the four groups of ingredients varied in the amount and composition of their ash in a remarkable manner.

The ash percentages obtained from the first coal examined—the Thick Seam, of Hamstead, South Staffs, were as follows:

	Ash P.Ct.
Fusain	15·59
Durain	6·26
Clarain	1·22
Vitrain	1·11

The four ashes showed considerable differences in colour and mechanical structure. Their characteristics have been confirmed in the examination of so many coals that they must be regarded as typical for the four components; and the mere appearance of the ashes may form a useful and definite guide for their identification, with the qualification that differentiation between clarain and vitrain is not always easy on account of their close similarity.

TABLE II.

Fusain.

—	Soluble in Water.	Soluble in HCl.	Insoluble in HCl.	Total.
	P.Ct.	P.Ct.	P.Ct.	P.Ct.
SiO_2	*Nil*	0·78	8·06	8·84
Al_2O_3				8·66
Fe_2O_3	0·19	8·33	4·06	3·37
MnO				0·51
TiO_2				0·04
CaO	10·03	46·64	0·33	57·00
MgO	0·41	0·89	*Nil*	1·30
Na_2O	0·65	2·59	..	3·24
K_2O	0·14	0·53	..	0·67
SO_3	4·71	9·17	0·77	14·65
P_2O_5	..	..	..	..
CO_2	0·53	2·45 (diff.)	..	2·98
Total	16·66	71·38	13·22	101·26
Total by direct weighing	16·57	71·38	12·05	100·00

Durain.

—	Soluble in Water.	Soluble in HCl.	Insoluble in HCl.	Total.
	P.Ct.	P.Ct.	P.Ct.	P.Ct.
SiO_2	Trace	1·46	49·08	50·54
Al_2O_3				42·34
Fe_2O_3	Trace	19·94	24·20	1·36
MnO				*Nil*
TiO_2				0·44
CaO	1·47	1·85	0·37	3·69
MgO	*Nil*	*Nil*	*Nil*	*Nil*
Na_2O	*Nil*	*Nil*	*Nil*	*Nil*
K_2O	*Nil*	*Nil*	..	*Nil*
SO_3	2·10	0·98	0·15	3·23
P_2O_5	..	..	..	..
Total	3·57	24·23	73·80	101·60
Total by direct weighing	3·48	23·81	72·71	100·00

Clarain.

—	Soluble in Water.	Soluble in HCl.	Insoluble in HCl.	Total.
	P.Ct.	P.Ct.	P.Ct	P.Ct.
SiO_2	0·12	0·96	8·36	9·44
Al_2O_3				16·58
Fe_2O_3	0·10	12·66	7·86	3·31
MnO				0·23
TiO_2				0·50
CaO	10·50	1·94	0·54	12·98
MgO	9·20	1·32	*Nil*	10·52
Na_2O	13·76	1·95	..	15·71
K_2O	*Nil*	*Nil*	..	..
SO_3	31·73	0·45	..	32·18
P_2O_5	*Nil*	0·01	*Nil*	0·01
Total	65·41	19·29	16·76	101·46
Total by direct weighing	65·24	17·86	16·90	100·00

Vitrain.

—	Soluble in Water.	Soluble in HCl.	Insoluble in HCl.	Total.
	P.Ct.	P.Ct.	P.Ct.	P.Ct.
SiO_2	Trace	0·76	5·32	6·08
Al_2O_3				15·49
Fe_2O_3	3·11	13·44	2·40	3·09
MnO				0·13
TiO_2				0·24
CaO	12·42	2·46	0·34	15·22
MgO	1·04	0·83	*Nil*	1·87
Na_2O	16·12	1·55	..	17·67
K_2O	0·20	*Nil*	..	0·20
SO_3	28·62	1·49	0·78	30·89
P_2O_5	..	..	..	Trace
CO_2	6·69	..	..	6·69
Total	68·20	20·53	8·84	97·57
Total by direct weighing	69·52	20·46	10·02	100·00

In Table II. are given analyses of the four coal components, and the lecturer explained on the basis of this analytical material the derivation of the inorganic substances. He referred to the differences between the Stopes components and Thiessen's subdivision into attritus and anthraxylon, explaining that Thiessen's classification rests on a botanical, and that of Stopes on a petrological, basis. It has recently been found by Seyler and by Miss M. Evans that by examining polished coal surfaces in reflected light morphological structure can be observed in vitrain which, in thin sections observed by transmitted light, had been found by Stopes to be a structureless gel.

Dr. Lessing suggested that the ash constituents will be found as useful an index of the component parts of a coal seam as type-fossils are in the identification of geological strata. Indeed, their significance should not be overlooked in any system of coal classification, whether for scientific or commercial purposes.

DISTRIBUTION OF MINERAL MATTER IN COAL.

The analytical material available enables us, even at this juncture, to correlate with a great measure of confidence the ash-forming substances with the actual coal components, and to determine the general distribution of mineral matter in bituminous coal, of which Table III. gives an example. During

TABLE III.—*Ash in Graded Fractions Contained in Lump Coal from the Thick Seam, Hamstead Colliery.*

FRACTIONS: PERCENTAGE ON ENTIRE SAMPLE.

Screen.	Grading Test.	Dust.	Clarain-Vitrain.	Durain.	Dirt.
On 5	5·70	Trace	4·81	0·85	0·04
Through 5 on 10	63·70	Trace	41·84	21·64	0·22
,, 10 on 20	12·90	0·05	7·96	4·84	0·05
,, 20 on 30	6·50	0·03	4·07	2·35	0·05
,, 30	11·00	3·75	4·88	2·27	0·10
Loss on sifting	0·20	..	..	..	..
	100·00	3·83	63·56	31·95	0·46

ASH: PERCENTAGE ON FRACTIONS.

On 5	..	..	2·28	5·74	29·64
Through 5 on 10	..	..	1·85	4·62	30·57
,, 10 on 20	..	..	1·30	4·26	46·02
,, 20 on 30	..	..	1·25	4·45	50·42
,, 30	..	2·98	1·90	5·58	63·19

ASH: PERCENTAGE ON ENTIRE SAMPLE.

On 5	0·17	..	0·11	0·05	0·01
Through 5 on 10	1·84	..	0·77	1·00	0·07
,, 10 on 20	0·33	..	0·10	0·21	0·02
,, 20 on 30	0·17	..	0·05	0·10	0·02
,, 30	0·39	0·11	0·09	0·13	0·06
	2·90	0·11	1·12	1·49	0·18

recent years a number of coals have been investigated by others along the lines adopted by Dr. Lessing. The results from the examination of many coals on similar lines and the complete analysis of the ash of their various fractions broadly indicate the following distinctions:

1. Clarain and vitrain contain the inherent plant ash or what remains of it, from 1·1 to 1·3 p.ct., consisting largely of water-soluble and a small percentage of acid-insoluble matter, not strictly belonging to these components.
2. Durain yields about 6 to 7 p.ct. of ash, being mostly clay substance.
3. The ash in fusain may vary from 4 to 30 p.ct., and contains much acid-soluble salts derived from infiltration, together with some clay substance.
4. Cleat and partings have a composition similar to that of fusain.
5. Pyrites and marcasite are distributed in different varieties of crystal form and size.
6. Rock débris from roof, floor, and dirt bands of the coal seam accounts quantitatively for the bulk of the ash in commercial coal.

CHEMICAL CHANGES DURING INCINERATION.

The reactions taking place in the conversion of the mineral matter in coal into ash may involve single compounds—such as the dehydration of silicates, the decomposition of calcium carbonate or of pyrites—and are accompanied by loss of volatile compounds. In other reactions, original constituents such as iron compounds are oxidized or reduced. Secondary reactions may affect the balance between volatile and non-volatile matter, while another class of reactions occurs between the residual mineral constituents themselves. Their consideration would cover the whole field of the chemistry of silicates and ceramics.

Some of these reactions have a profound influence on the proximate and ultimate composition of coals as ascertained by ordinary routine tests. In arriving at an estimate of the true coal substance in a given coal, allowance should therefore be made for the water of hydration, carbon dioxide in calcium (or iron) carbonate (which according to the temperature employed may be more or less completely dissociated), the combination

of organic sulphur with lime and alkalies, resulting in the formation of sulphates, the partial volatilization of alkali chlorides or their conversion into carbonates and a number of other reactions for which reliable data are not yet available. Moreover, it must be remembered that the incineration of coal is not a combustion process pure and simple, but that it is preceded or accompanied by non-oxidizing thermal decomposition.

ANALYSIS OF ASH.

These factors prove that the ordinary methods of estimation of ash, while permitting a satisfactory comparison of their amounts, do not give a true picture when the results are used for calculating the pure ash-free coal substance.

As to ash composition, the testing of commercial, well-ground and homogenized samples gives only compound values. A rational analysis of the mineral constituents presupposes a separation of the unburnt coal components on the lines discussed before.

PHYSICAL STRUCTURE OF MINERAL CONSTITUENTS.

Even the detailed chemical analysis of individual coal components does not suffice for a complete study of the distribution of the inorganic compounds in coal; and it must be supplemented by methods divulging their physical structure and articulation. This can be done in a simple and very instructive way by incinerating lumps of coal—uncrushed, instead of in the usual powdered mixture—when the ash is obtained in form of a skeleton representing its original orientation in the compact mass of coal. The thin veins of calcite or ankerite in cleat and partings show up in distinct lamination, and intrusions of pyrites or shale particles become clearly visible. There is, however, a difficulty in preserving such tender structures for measurement or demonstration. The microscopical examination of ash skeletons of plants gives frequently a clear and more comprehensive view of certain morphological conditions than the tissue itself. Spodograms obtained from coal show the original structure very clearly.

EXAMINATION BY X-RAYS.

Radiographic methods recently introduced by Kemp for the examination of coal provide an important adjunct to the study of its mineral constituents. Properly correlated with the results from the chemical analysis, the radioscopic and radiographic examples will be found exceedingly helpful in this important branch of coal research.

A series of lantern slides illustrating the structure and appearance of coal components and mineral matter in coal, as obtained by the microscopic examination before and after ashing, and by radiographic methods, was shown; and a collection of specimens relating to the composition and distribution of inorganic compounds in coal and a series of samples ranging from peat to anthracite were on exhibition. A demonstration of the carboscope devised by Mr. C. N. Kemp for the X-ray examination of coal samples was given.

The remaining lectures will be delivered on Nov. 30 and Dec. 7.

The "F.B.I." and Conditions in America.

A report compiled by Colonel the Hon. F. Vernon Willey (President of the Federation of British Industries) and Mr. Guy H. Locock, C.M.G. (Assistant Director), upon their recent mission to the United States, puts in a concise and practical manner an important collection of facts relating to the prosperity of America. Reference to the report was made at the luncheon of the Society of British Gas Industries by Sir Robert Hadfield, who pointed to the evidence therein contained that in the United States greatly exaggerated ideas are entertained as to the commercial difficulties which are at present being experienced in this country. That such ideas must prove harmful to our trade is unquestionable; and their obliteration is therefore a matter of urgent moment. The report, on the other hand, contains abundant proof of the prosperity and overwhelming wealth of the United States to-day. Some of the figures quoted to show this are amazing. Last year 74 people in the United States had net incomes of over £200,000; and at the other end of the scale are to be found the returns of the savings banks, which have doubled in the last seven years. A table is given to show the percentage of American production or resources as compared with world production or resources in certain commodities; and the figures are illuminating. The highest are under the heading of "Automobiles registered;" America's percentage of the world's total being 82·7. Of the world's pig-iron production, America's percentage is 60·2; and of the world's rubber consumption, 70·9. Of the coal production of the world, the percentage of America is 43·5; and of the petroleum production, 71·9. The reporters found the general trend of business highly satisfactory, without any indication of a slackening in the volume of trade. The financial position of the United States is sound; and the considered opinion given in the report, on all the facts, is: "There is no doubt that as time goes on the United States will become increasingly a factor in world trade; and we shall meet with increasingly severe competition from her."

DEHYDRATION OF TAR.

A lecturette on the subject of the dehydration of tar (illustrated by lantern slides) was delivered on Friday evening, Nov. 20, by Mr. GERALD E. WILLS, before the Junior Institution of Engineers. It was a concise account of a very useful process—now that tar is so largely employed for road surfacing. The author explained that, though dehydration means the driving-off of the water contained in the crude tar, as practised, it is really a partial distillation process, as, in addition to the water, light oil is also driven-off. The treated tar is far more suitable for road making operations than crude tar, because it is free from water; it is much more viscous, thus enhancing its binding qualities; and it has in it a smaller proportion of constituents likely to harm fish when the surface water drains into rivers.

"CASCADE" CONTINUOUS PLANT.

The first method described was the "Cascade" type of continuous tar dehydration plant, in which the still is heated by a coke-fired furnace. When the crude tar enters the still, it flows down a cascade made of steel plates welded in position, and in so doing spreads into a thin, even stream, finally passing to the bottom of the still. The vapours from the hot tar pass through the cascade, and drive-off the water from the thin film of tar flowing down, so that the crude tar is deprived of its water content before it reaches the bottom of the still. The plant requires little attention; the main point being to see that the temperature is maintained fairly constant. This temperature should usually be between 375° and 400° Fahr. when working to Road Board Specification No. 1, and about 50° higher when working to Road Board Specification No. 2.

HIRD STILL.

The Hird type of still is made of cast iron, and the method of heating the tar is similar to that employed in marine boilers. Heating tubes run horizontally from end to end of the still, and are expanded into the end-plates. Baffles are arranged inside the still, in order to direct the flow of tar along the length of the tubes. The crude tar is used partially to condense the vapours from the still.

WIKNER PLANT.

Another system which uses steam as a heating agent is the Wikner plant, which includes a welded steel still divided horizontally into two portions. The upper portion contains the tar which is being dehydrated; the necessary heat being supplied by live steam, which travels through a number of tubes expanded into the end-plates. The vapours arising from the dehydrated tar pass through a number of tubes to the lower portion of the still, which they traverse from end to end in a zig-zag manner, preheating the incoming crude tar. The system is easy to control; but the temperature at which the tar is dehydrated depends entirely upon the boiler pressure available, and may or may not be suitable for preparing tar to the necessary specifications, according to the characteristics of the original crude tar. It is, the author said, usual to employ this plant as a primary still; the hot tar flowing from it into a still of the usual type, where the final distillation is carried out.

"SLOUGH" SYSTEM.

In the "Slough" dehydration plant no brick setting is required for the still, which is in the form of a multitubular vertical boiler. Here, again, the crude tar is used partially to condense the vapours before it enters the heat-interchangers.

"T.I.C." PROCESS.

The "T.I.C." system is unique, in that a metal of low melting point is used to transfer heat from the furnace to the tar. A mild steel still is employed containing the metal, which melts when the plant is put into operation. The tar is dehydrated by flowing in a comparatively thin film over the surface of the hot metal. The metal in its fluid state ensures a quick transfer of heat to the tar; and local heating of the still cannot occur. Another result of efficiency of heat transfer is the large capacity of the plant compared with its size. The quantity of tar contained in the still at any one time is very small; but, of course, the rate of flow is fairly rapid. The tar is made to take a spiral course during its travel through the still.

WILTON PLANT.

The Wilton plant differs from all the preceding types in that the still is in the form of a cast-iron coil, through which the tar is pumped under a pressure of from 10 lbs. to 30 lbs. per sq. in. After leaving the still, the hot tar passes through a regulating valve into a vapour box, where the light oil and water vapours separate from the dehydrated tar, which falls to the bottom of the box, and flows to the heat-interchanger, in order to preheat the incoming tar.

TESTING THE TAR.

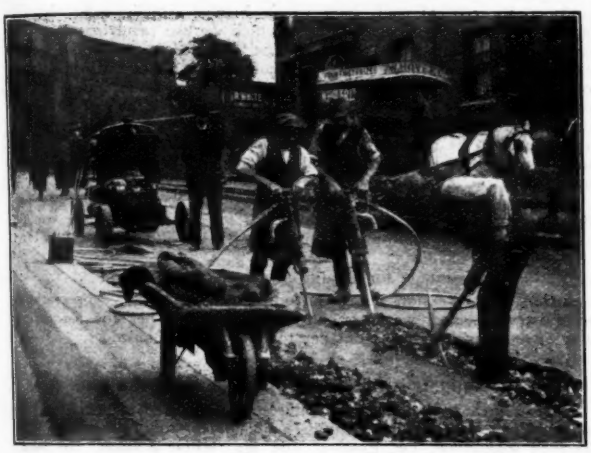
The dehydrating plant may be worked to produce either tar for road surfacing or tar for preparing tar macadam. In order to ascertain whether the tar is being produced to the Road Board Specifications, it is necessary to take samples periodically for testing; and the author concluded his lecturette by describing the general arrangement of the apparatus required for the purpose, and the method of carrying out the various tests.

PNEUMATIC PLANT FOR GAS WORK.

The accompanying illustration is of work being carried out for the Croydon Gas Company by Mr. W. J. Sandeman, their Distributing Engineer. This Company have recently purchased a pneumatic outfit which is in regular use in connection with the laying of new mains, and also the repairing of old ones. In using this equipment, we understand, the labour cost is reduced to a minimum, and the work is rapidly and efficiently performed.

The plant was manufactured and supplied by Messrs. Lacy-Hulbert & Co., Ltd., Pneumatic Engineers, of Boreas Works, Beddington, Croydon, and Victoria Street, Westminster, who have specialized in the manufacture of portable air compressors particularly suitable for this class of work.

The small portable compressor illustrated at work is capable of driving two heavy pneumatic picks for cutting out concrete, macadam, &c. The machine runs smoothly and quietly, so that, apart from the noise made by the actual picks themselves, no inconvenience is caused. The machine appears to lend itself readily to being moved along the road, and it requires practically no attention beyond the supply of petrol and lubricant—the consumption being about a gallon of petrol per hour when on full work.



By using this outfit, the work can be expedited considerably; and the machine can be used not only for breaking-up the road surface, but also for operating clay diggers, caulking hammers, and tampers.

These pneumatic machines are made in various sizes, and supplied either mounted on wheels for haulage by man-power or tractor, or, when desired, on a motor lorry, and driven by the same engine which propels the vehicle.

A number of gas companies use this plant with success and satisfaction—for example, the South Suburban Gas Company, the Wellingborough Gas Company, and the Chester Gas Company. When not needed for work on mains, the portable compressor plant can be usefully employed in the works for carrying-out all kinds of repairs, such as drilling, riveting, caulking, chipping, paint spraying, sand blasting, &c., so that an equipment of this kind appears to be a great source of economy to any gas undertaking.

Electrolytic Production of Oxygen.

In a paper on the manufacture of oxygen read by Mr. A. E. Knowles at a meeting of the Institution of Welding Engineers on Nov. 12, the author said that when he commenced manufacturing electrolytic oxygen, there was practically no demand for the hydrogen produced at the same time. The recent developments in the hydrogenation of oils, however, altered this. The process, like nearly all synthetic processes, demanded absolutely pure hydrogen, and to-day this was all produced electrolytically, yielding oxygen of high purity as a bye-product. Each ton of oil treated required from 3000 to 5000 c.ft. of hydrogen. At one time, said the author, these plants were treating about 4000 tons of oil a week, so that there was produced about 10 million c.ft. of bye-product oxygen per week. The manufacture of synthetic ammonia was being developed throughout the world, and in many cases electrolytic hydrogen was being used. Mr. Knowles said that last year he started a plant in Italy producing about 14,000 c.ft. of hydrogen and 7000 c.ft. of oxygen per hour; and he had a plant in hand for France producing 70,000 c.ft. of hydrogen per hour. Many much larger plants were under consideration. At present the bye-product oxygen from these plants was nearly all wasted. Many other processes requiring hydrogen, remarked the author, were in the experimental stage; and it seemed certain that shortly the bye-product oxygen produced would be an economic factor in controlling the price and the quality of oxygen made by other methods. The gases produced by certain electrolytic plants were 8 c.ft. of hydrogen and 4 c.ft. of oxygen per KW.-hour.

AMERICAN GAS ASSOCIATION.

Annual Convention at Atlantic City.

(FROM AN AMERICAN CORRESPONDENT.)

The one event to which our gas men look each year has come and gone. The Atlantic City meeting of the American Gas Association was, generally speaking, "bigger and better" than ever. Once again the industry has shown how much strength there is in union. One who has been connected with gas association work off and on for thirty years finds it hard to realize that only ten years ago the goal of a single national association seemed as far off as ever. The seven-year-old child has, from its birth, been a lusty infant. In fact, it has grown so fast that there are signs of clothing outgrown. The Technical Section was organized to care specifically for engineering subjects. However, manufacture and distribution have in many cities reached vast proportions, and there are now many men in our industry whose interest is in only one of these subjects. For such men, many hours of the Association sessions are of slight value. In the last two years the Distribution Committee of the Technical Section have sought to meet the need of more time for the discussion of purely distribution problems by inviting to their Committee meeting all distribution engineers. Such a meeting held in Detroit in June occupied two days, and brought together 130 men.

When we consider the large amount of our annual investment in mains, meters, and services, and the further fact that we in America are not a unit on some important points of street main material and joint design, and consumers' meter standards, there is every reason to encourage any form of meeting and discussion calculated to bring about standard practices based on sound engineering principles. The experience of certain companies would indicate that other companies could adopt with perfect safety less expensive distribution standards. Therefore, it behoves our Association staff to further to the greatest possible extent the consideration of all yet unsolved and important problems.

One of the greatest advantages resulting to a group in the gas industry through the formation of the American Gas Association is shown by the present vigorous conditions of the Accounting Section. In 1914, at a meeting of the American Gas Institute (predecessor of the American Gas Association), provision was made for two Accounting Sessions. This was the first time that the gas accountants had the opportunity to discuss together their own special problems. Though the sessions were very successful, no similar opportunity offered till 1919, when the present Accounting Section started. It found much to be done, and has made splendid use of the time. Entirely due to the failure of various gas associations to recognize the accountant and give him a proper place in their meetings, there was no standard system of gas accounts in use throughout the country. Therefore, when State after State appointed Utility Commissions to supervise gas company operations, these Commissions, finding the gas industry not a unit as to accounting methods, devised their own obligatory accounting systems. The variations between these systems as used in 48 States have been a serious handicap to holding companies owning gas companies in more than one State, and to all who wished to compare operating results. For this and other reasons we have had no "Field's Analysis."

The Accounting Section has applied itself with much patience and industry to this difficult problem of obtaining a national standard of accounts, and each year witnesses a nearer approach to the goal. It is now turning to another field, where standards of cost-keeping promise great advantage. Within the last five years, and to a large extent within the last two, portable air compressors, and trenching and refilling machines, with gasoline as their power source, have become standard distribution equipment for many companies—to such a degree that the cost of this equipment in a large city may equal $100,000. While, due to the scarcity of common labour resulting from our present immigration laws, the substitution of mechanical power for hand labour is in many instances necessary, even though no gain, or a slight loss, results, there are many reasons for desiring accurate cost records for these new agents, and for the ability to compare results obtained as between various gas companies. This is the job to which the Accounting Section is now turning as one of its activities, through a committee composed of accountants and engineers.

Your problems are not entirely similar to those in this country; but possibly what has here been written will be of interest to you.

Bedford Preference Stock Issue.—Messrs. A. & W. Richards advertise elsewhere in this number of the "JOURNAL" an issue of £25,000 of 6 p.ct. irredeemable preference stock in the Bedford District Gas Company, which they are making on behalf of the Directors. Thursday morning, Dec. 3, is the latest time for the receipt of tenders by the firm, at 37, Walbrook, E.C. The capital is required to purchase additional land, to provide for the erection of a new holder, and for main extensions.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Coke-Cutting Machines.

SIR,—Having read with much interest Mr. S. E Whitehead's prize-winning paper on "Coke Preparation" in the Coke Competition number of your Journal, dated Nov. 9, we cannot permit the following statement to pass without comment—viz.:

> Coke-cutting machines are inveterate "breeze makers," and should be avoided wherever local conditions allow. The additional quantity of fine breeze and dust made during cutting with average coke and a good type of cutter is 20 p.ct.

If his remarks are intended to apply to certain coke crushing or breaking machines, we have nothing to add; but, being the originators of coke-cutting machines—and, we believe, the only manufacturers of these—we unhesitatingly challenge his figures. From our own experience, covering many years, and from reports of tests carried out independently by our customers in their works, we find that the percentage of fine breeze and dust made during cutting is very considerably less than Mr. Whitehead's estimate.

We shall be pleased to place at Mr. Whitehead's disposal, and without obligation to him, one of our machines, to enable him to carry out tests, the results of which, we believe, would prove the inaccuracy of his statement as applied to coke-*cutting* machines.

ROBERT CORT & SON, LTD.

Kennet Iron Works,
Reading,
Nov. 20, 1925.

Low-Temperature Balance-Sheet.

SIR,—I herewith send you a copy of a balance-sheet, to correct the astonishing miscalculation given by Mr. Milne Watson in his evidence before the Coal Commission on Nov. 4, when he gave a balance-sheet of profit and loss on the operation of the "Coalite" process as compared with gas-works practice.

I should be glad if you would publish this Company's balance-sheet, which I have put alongside Mr. Milne Watson's figures.

N. G. THWAITES,
Director.

Low-Temperature Carbonisation, Ltd.,
14-16, Cockspur Street, S.W. 1,
Nov. 20, 1925.

MEMORANDUM ON MR. D. MILNE WATSON'S FIGURES RELATING TO PROFIT AND LOSS ON THE OPERATION OF THE COALITE PROCESS, AS COMPARED WITH GAS-WORKS PRACTICE.

The accompanying balance-sheet gives Mr. Milne Watson's figures of the Cialite proces and gas-works practice, and alongside it the corrected figures of the Coalite process. The most flagrant mistakes made by Mr. Milne Watson are in the figures he puts for the cost of coal for the Coalite process, and fuel costs for retort heating, which make all the difference to the Coalite balance-sheet.

Low-temperature carbonization, as practised at Barnsley, utilizes small slack coal, procurable at 10s. per ton, and not 30s. as Mr. Milne Watson calculates. However, to be well on the right side, I have taken this cost as 15s. per ton in my corrected balance-sheet.

He is also wrong in the price obtained for Coalite smokeless fuel, which he puts at 32s. per ton, as he does for coke. The average price of Coalite during the first six months of this year was 36s. 6d. per ton. Incidentally, the price of gas-works coke to-day is in the neighbourhood of 20s., and not 32s. as stated by Mr. Milne Watson.

Taking the items in order,

(1) I observe that Mr. Milne Watson calculates the value of gas at 4d. per therm. This Company could sell their gas at a lower figure than this for the benefit of gas concerns and their customers, but I have allowed his figure to stand in my corrected figures.

(2) Tar and Oils.—At the time Mr. Milne Watson gave his evidence (Nov. 4) we could not find a higher price for high-temperature tar than 30s. to 32s. per ton, and yet he puts it at 4d. per gallon, or £3 10s. per ton. In the case of Coalite fuel oils, for some years we have sold our crude Coalite oils at 5d. or more per gallon, and pot 4d. We sold our last 1000 tons at an average of 82s. 11d. per ton, and contracts are now before us for next year's supplies at as high as 92s. per ton.

(3) I have left ammonia at the figure stated by Mr. Milne Watson.

(4) Mr. Milne Watson values spirit at 6d. per gallon. This is obviously incorrect, as large quantities can be sold at 1s., for the simple reason that this fuel, as certified by experts' reports, is some 15 p.ct. higher in efficiency than No. 1 Aviation Spirit from petroleum.

(5) Coke.—Mr. Milne Watson calculates this as worth 32s. per ton. As I have already stated, our sale price for Coalite smokeless fuel during the first six months of this year was over 36s. per ton at the works. When large plants are in operation, the price can be greatly reduced.

(6) I leave breeze as Mr. Milne Watson has it.

Our gross products, therefore, amount to 43·52s. instead of 42·65s.

With regard to the next item, cost of fuel for retort heating, Mr. Milne Watson gives a ridiculous figure when dealing with the Coalite process, as the actual cost is not more than about 1s. 8d. per ton, and not 13s. 8d. per ton.

As to the cost of coal, with which I have already dealt, let me emphasize that the small slack coal which we use rarely exceeds 10s. a ton. These low-priced coals can be obtained in unlimited quantities, and need not have a high ash content, as modern washing processes, at a cost of only 6d. per ton, give a perfectly clean, good, raw material. It is, in fact, safe to say that the total cost of small coal, washing, and conversion into Coalite products amounts to about 15s., and can be made to yield commodities worth, in large works, not less than 30s. per ton of coal carbonized. With appropriate refining and fractionating, the values can be greatly increased.

To summarize, the balance for profits and working charges for the Coalite process is not less than . . . . . 26·86s. per ton,
as compared with high-temperature gas-works . 14·81s. „ „

Profit advantage for Coalite process . . . 12·05s. „ „

N.B.—As conversion costs, including maintenance, depreciation, administrative, and working, do not exceed 5s. per ton in large plants, there is over 7s. profit per ton of coal carbonized.

Coal Industry and Carbonization Contributions.

SIR,—I have read with much interest the reported evidence at the Royal Coal Commission sittings—particularly that given by Sir Richard Redmayne, Dr. Lessing, and Mr. Milne Watson. In view of my claim to have solved the carbonization problem in its more general features, I would be grateful to you if you would publish the following comments.

I would like to demonstrate how my method of carbonization would stand in relation to the essential conditions for success laid down by the above gentlemen. First, take Sir R. Redmayne's five conditions—namely:

(1) That the price of the raw fuel—*i.e.*, the coal to be carbonized—is such that the price of the resultant Coalite would be sufficient to meet it.
(2) That an outlet be found for the residual fuel—that is, the partially coked coal, or Coalite, as it has come to be designated.
(3) That a market be found for the waste gas produced by the process.
(4) That the fuel-oil market be a steady one.
(5) That the working and maintenance costs be not excessive.

The first table on p. 527 reveals the relationship obtaining in (1) above.

At the present time house coal is sold at 45s. per ton (London) whereas gas coke runs around 20s. to 32s. 6d. per ton. The lower limit would only be possible in the case of cheap slacks requiring treatment immediately at the colliery; whereas on the higher side it will be seen that, under present conditions, 30s. would be the maxi-

Mr. D. Milne Watson's Figures.					Corrected Figures.		
Products.	Coalite.		Gas-Works.		Products.	Coalite.	
	Quantity.	Value.	Quantity.	Value.		Quantity.	Value.
		Shillings.		Shillings.			Shillings.
Gas at 4d. per therm	39 6 therms	13·20	72 therms	24·00	Gas at 4d. per therm	39·6 therms	13·2
Tar and oils, 4d. per gallon . .	18·62 gallons	6·21	10 gall ns	3·33	Tar and oils, 4d. per gallon . .	18·62 gallons	6·2
Ammonia, 3s. 6d. per butt . .	0·24 butt	0·84	0·28 butt	0·98	Ammonia, 3s. 6d. per butt . .	0 24 butt	0 84
Spirit, 6d. per gallon	1·78 gallons	0·89	..	..	Spirit, 1s. per gallon	1·78 gallons	1·78
Coke at 32s. per ton (average price)	13·23 cwt.	21·17	13 00 cwt.	20·80	Coke at 32s. per ton (average price)	13 23 cwt.	21·16
Breeze at 10s. per ton	0 69 cwt.	0·34	1·00 cwt.	0·50	Breeze at 10s. per ton . . .	0·69 cwt.	0·34
Gross products	..	42·65	..	49·61	Gross products	..	43 52
	Gas.		Coke.			Gas.	
Less cost of fuel for retort heating	39·6 therms	13·20	3·0 cwt.	4·80	*Less* cost of fuel for retort heating	..	1·66
Less cost of coal per ton . . .	..	30·00	..	30·00	*Less* cost of coal per ton . . .	..	15·0
		Loss.		Gain.			
Balance for profit and working charges	..	0·55	..	14·81	Balance for profit and working charges	..	26·86

Price of Coal, *plus* Handling and Transport Charges.	Selling Price of Coalite.
10s.	70 p.ct. basis . . 14s. 3½d.
15s.	70 ,, . . 21s. 5d.
20s.	70 ,, . . 28s. 7d.
25s.	70 ,, . . 35s. 8½d.
30s.	70 ,, . . 42s. 10½d.
35s.	70 ,, . . 50s. 0d.
40s.	70 ,, . . 57s. 2d.

mum priced material liable to treatment, even if the resultant Coalite realized 43s. in the immediate district. For other cases 20s. per ton would be the upper limit; and if gas coke were to be considered, for gas-works practice 20s. to 25s. would be a fair upper limit, assuming in all cases a throughput about equal to high-temperature gas-works practice.

The satisfaction of condition (2) is but a matter of the zoning of the temperatures employed within the retorts. A maximum charge (average) temperature below about 750° C., having higher flue temperatures where one-sided heating is used, is best for a heavily oil-yielding fuel like shale or cannel; but for bituminous coals, from 700° to 950° C. may be used, provided staged operation is employed (see patent specification No. 213,363), still leaving, according to the fineness of the coal particles, the rate of carbonization, and the plastic developments during treatment, a highly combustible and readily ignitible compact, hard, large-sized (*i.e.*, without excess breeze, all of which may be returned to the retort) residual smokeless volatile coke, for which a ready sale could be assured.

The satisfaction of condition (3) is merely a question of gas quality, which in turn devolves upon the mode of heating. In an article published in " Industrial India " for February, 1923, written by Mr. D. Brownlie, upon my system, it will be seen that I conservatively stated the gas quality at 500 B.Th.U. per c.ft. for a yield of 40 therms per ton (8000 c.ft.), by combined heating. In fact, however, anything between 500 and 750 B.Th.U. per c.ft. can be realized in approximately the following manner: 70 therms of 500 B.Th.U. quality; 60 therms of 600 B.Th.U.; 50 of 700 B.Th.U.; 45 of 750 B.Th.U., for external heating and steaming only.

The satisfaction of condition (4) devolves upon the quality of the oils realizable from the primary tar, and the fact that it is, at the temperatures above mentioned (around 700° C.), possible to realize an optimum oil yield using steam to assist slightly in the process, as also the hydrogenizing influence of nascent hydrogen liberated in bulk around this temperature from the coal, and which does not appear in operations conducted below about 650° C. Further, a tar which is an improvement upon, but otherwise very generally similar to, that of a vertical retort is thereby obtainable. With Dr. Lessing's pitch-removing process, a most useful oil-recovery procedure thereby becomes available.

The satisfaction of condition (5) surely mainly lies with the enhanced throughput realizable, without any appreciable sacrifice of fuel economy or depreciation of plant, or increased capital outlay per ton of fuel carbonized, as compared with present modern gas retort or coking installations. This I have already clearly proved to have been obtained in my system. In order to prove that the system offers a ready-to-hand means for carbonization of the 210,000,000 tons, in part or even as a whole, the following balance-sheet is given:

Products: (1) Everard Davies' System, 700° to 950° C. (Steaming).	Quantity.	Value.	(2) Gas-Works. Present Practice (Mr. D. Milne Watson's Basis).	Quantity.	Value.
		s. d.			s. d.
Gas at 4d. therm	70 therms	23 4		72 therms	24 0
Tar and oils, 4d. gal.	20 gallons	6 8		10 gallons	3 4
Ammonia, 3s. 6d. butt	0·3 butt	1 2		0·28 butts	1 0
Spirit, 6d. gal.	2 gallons	1 0		—	—
Coke at 32s. ton (average price)	14 cwt.	22 5		13 cwt.	20 8
Breeze at 10s. ton	—	—		1 cwt.	0 6
Gross products		54 7			49 6
Less cost of fuel for retort heating	coke, 1½ cwt.	2 5		coke, 3 cwt.	4 10
Less cost of coal per ton at		20 0		at	30 0
Balance for profit and working charges	gain	32 2		gain	14 8

The figures in column (1) above, of course, assume for raw material a blend of coking coals and slacks with non-coking slacks (washed), though not blended in any special way as a means of rendering it amenable to retorting, but merely as an advantageous procedure for commercial and product-quality considerations. Its calorific value would, however, require to be about 14,000 B.Th.U. per lb., if not higher, to realize the above results, which therefore represent a peak fruitage. The figures can, however, readily be shown to provide a working proposition, even if coal costs 30s., and some 5s. is deducted from the values of the yields due to lower quality coal being supplied, which would still leave a balance of 17s. 2d., as against gas-works practice with 14s. 8d. But it must be borne in mind that the gain under the Everard Davies system can certainly be reduced to 10s. per ton, and still compete with present gas-works practice; there being considerably lower working and capital charges in the former case as compared with the latter. In view of this fact, the system applies generally to treatment of any material, provided the blended volatiles are in relation to the price of the raw coal approximately above the following critical limits:

Volatile of Raw Fuel.	Maximum Price per Ton of Raw Fuel as Charged into Retorts, including all Preparation.
P.Ct.	
45–35	30–35/- for a throughput basis of 30–50 tons daily per 8 tons standing charge in retorts.
30	28–30/-
25	17–20/- The prices are for the separate coals in any mixture
20	12–15/- treated rather than for the blend as a whole, but to
15	8–10/- which they also approximately apply.

The requirements of fuel for household purposes in Great Britain amount to about 35 million tons per annum, which, if subjected to medium-temperature carbonization, as above, would produce (say), at 15 gallons per ton, some 525 million gallons of primary tar. It will therefore be seen that this system is certainly unlimited in its application, except by the demand for its products. To substantiate this claim, the writer would agree to offer the Government, or any other body, an opening to instal a plant which will, in competition with any other system extant, realize at least 150 p.ct. of its commercial advantages for (say) an installation costing around £45,000—the plant to be used mainly for demonstration and research purposes, but to operate continuously under commercial conditions on a royalty basis, partly on cost and partly on profits over and above interest on capital, together with the necessary preliminary fees for supervision. The reasonably-to-be-expected advantages would run to well over twice those of any other system—modern high-temperature gas-works practice included—whereas the carbonizing capacity of such a plant would be guaranteed in the neighbourhood of 100-150 tons of coal daily, complete with accessory plant for the general recovery of tar and ammoniacal liquor, and sulphur purification, and would have a charge capacity of 25 to 30 tons.

In this connection, it may be as well to recapitulate what are the outstanding factors involved in this system of carbonization. The retorts comprise single or multi-staged verticals heated under preferably perfect combustion conditions by a patented combination of heating flues, built of carborundum refractory as to the combustion chambers and recuperators, and fireclay (or silica) as to the remainder, and positioned on one long side only of the retort chamber, with an off-take opposite for the distillate through a mid-wall forming a central partition between two adjoining retorts in a setting. Heat transmission is by this method of external heating—which, however, may be supplemented by a modicum of internal heating using steam and/or flue or extraneous gases (H_2, water gas, &c.)—raised to such a point that the rate of penetration of the carbonization temperature can be multiplied enormously (5 to 8 times has already been attained), as compared with present high-temperature practice, using the same charge width as in ordinary verticals. Accordingly, in further installations the width may be still further increased by (say) 3 in. in each experimental determination.

Evacuation of the coke without any extractor of the usual type, except for a sealing device, has proved readily possible, with the most satisfactory product as result. Passage of the distillate to the off-take being transversely (more or less) across the coking width, with an almost totally uninterrupted inward flow, primary yields are obtainable at high rates of carbonization. The temperature is absolutely under control within the limits of 700° to 1600° C., or more, in any of the heating stages; there being no pronounced reducing or oxidizing atmosphere—preferably a slight reducing atmosphere is used. The pressure likewise is controlled by sizing, suction applied, and pressure of injection of steam and other gases. Preferably vacuum off-take is used; the top of the retort being sealed, and off-take being solely through the mid-walls. The gaseous atmosphere is liable to wide variations respecting H_2, CO, CO_2, H_2O, CH_4, and other hydrocarbons, and tar vapours. Steaming is conducted through the bottom and the sides, being superheated in the latter case invariably, if not in the former also. The rate of travel of the charge is controlled in relation to coke-volatiles required (3 to 7·5), the distribution of the volatile therms between liquid and gaseous yields in relation to the stage heats in the charge length of travel, and the gas expenditure in the heating flues. Evidently, therefore, there is nothing which need essentially go wrong, and working is simplicity itself, once a given set of conditions has been determined. In this latter respect certain definitely ascertained suitable working conditions can be built into the design by just arranging the sizes of the stages and the number thereof. In other words, while the plant automatically fulfils any carbonization requirements under the sun, it will not require any skill in actual working on the part of the operatives, who merely carry out a predetermined time-table. A suitable taper answers any expansion requirements of a coking coal. Of course, there are other variable factors which may be incorporated into the above scheme as minor features.

Mr. Milne Watson made reference to many items of research to which the larger gas undertakings had recently applied themselves, including:

(1) Carbonization of blended coals with particular reference to:
- (*a*) The production of coke of an improved quality.
- (*b*) An increase in the throughput of existing carbonizing plant.
- (*c*) The utilization of low-quality non-caking coals hitherto considered unsuitable for the manufacture of gas or coke, or, alternatively,
- (*d*) The utilization of all coke breeze, and its conversion into large coke.
- (*e*) The obtaining of increased yields of gas and tar from caking coals such as are used at present.
- (*f*) The conversion of pitch used in briquetting blended coals into more valuable gaseous and liquid products.

(*a*) is satisfied in the writer's patented process No. 213,040; also an arrangement with Mr. J. Roberts respecting his processes has been

made for rights abroad, and is doubtless possible for the home rights if, and as, required.

(*b*) has been proved to the point stated.

(*c*) is satisfied by processes No. 213,040 and No. 213,363.

(*d*) is readily realizable in the writer's system.

(*e*) 100 therms of gas of 500 B.Th.U. per c.ft. per ton of coal of 14,000 B.Th.U. per lb. when carbonizing with steaming under 30 p.ct. is attainable, when working at high temperatures over 1100° C. in the charge.

(*f*) is satisfied by the writer's process in Patent No. 127,940.

Further, item (2), "the separation of ash from coal, or, alternatively, from coke," has been facilitated by the capacity of the Everard Davies system to gasify to ash washery débris; temperatures of 1100° to 1500° C. in the charge being realizable without aeration of the charge to any appreciable degree. Item (3), "the thermal decomposition of hydrocarbons such as tar vapours," is readily facilitated by returning tar to the retort. (The Fuel Research Board, on carburetting vertical retort gas with gas oil by direct injection into the retort.)

I think, therefore, it can be readily stated, without fear of contradiction, that this system affords Mr. Milne Watson the means for satisfying every important desideratum advanced by him. If this is not the case, the writer would be glad to learn reasons for the opposite conclusion.

WM. EVERARD DAVIES.

5, Tymbedw Terrace,
Treorchy, Glam.,
Nov. 8, 1925.

REGISTER OF PATENTS.

Removal of H_2S, &c., by Liquid urification.

No. 240,891.

THE KOPPERS COMPANY, of Pittsburgh.

No. 13,781; June 5, 1924.

This invention relates to the process for removing H_2S, &c., from gas by washing with an alkaline liquid, preferably a solution of sodium carbonate. It consists in transferring the H_2S and other impurities from the gas to a stream of air, washing this air with a liquid containing an iron compound capable of decomposing the H_2S, and regenerating the air-wash liquid by means of air. The air discharged from the actifier (described in previous patents) is then no longer a source of nuisance. As an incidental bye-product, some free sulphur is recovered. The steps in the process are briefly as follows: The gas is first of all washed in an absorber with an alkaline liquid. The fouled liquid is regenerated in an actifier by aeration; and the air containing H_2S is then washed by a counter-flowing alkaline liquid containing an iron compound having an affinity for sulphur. The chemical reactions are exemplified in the following equations:

Absorption of H_2S, CO_2, and HCN by a solution of Na_2CO_3:

$$Na_2CO_3 + H_2S = NaHS + NaHCO_3$$
$$Na_2CO_3 + CO_2 + H_2O = 2NaHCO_3$$
$$Na_2CO_3 + HCN = NaCN + NaHCO_3$$

Interaction of $NaHCO_3$ and NaHS with Fe_2O_3:

$$3NaHS + 3NaHCO_3 + Fe_2O_3 = Fe_2S_3 + 3Na_2CO_3 + 3H_2O$$

Action of air on iron sulphide:

$$2Fe_2S_3 + 3O_2 = 2Fe_2O_3 + 6S$$

Part of the sodium hydrogen sulphide may react with the air and free sulphur present, resulting in the formation of sodium thiosulphate. This salt may be allowed to accumulate, and can be recovered. The free sulphur is allowed to accumulate in the suspension. From time to time part of the sludges may be withdrawn for the recovery of sulphur and iron oxide; and fresh oxide and dissolved alkali are added to maintain the concentration.

In another modification of this process, iron oxide is used in a water suspension, instead of an alkaline solution. The efficiency of H_2S removal is lower, but enough H_2S is removed from the air, so that it may be unobjectionably disposed of. At the same time free sulphur is recovered.

No. 241,248.

No. 14,049; June 10, 1924.

From the chemical standpoint, the removal of the sulphur from air which has been passed through the actifier, as in the previous specification, offers but little difficulty, but from the industrial and commercial point of view the removal, cheaply and effectively, of the small traces of H_2S from the large volume of air employed in the aeration is a difficult problem. It has been found that the natural iron oxide and artificial iron compounds previously employed by the patentees in the washing stage of the cyclic process are less active than is desirable, and even the precipitated material prepared and stored for some time loses some of its effectiveness. This invention, therefore, consists in a cyclic process for the elimination of H_2S, comprising the steps of washing the air with a suspension of a freshly-precipitated iron compound in an alkaline solution, revivifying the suspension by oxidation, and re-employing the revivified suspension in the washing stage. The precipitation of the iron compound may be effected either as a step within the complete cycle of the gas purification process, or it may be done outside this cycle.

No. 241,452.

No. 7711; June 10, 1924.

This invention relates to an apparatus for the oxidizing of the spent liquid in the foregoing process. It consists in oxidizing the sulphide by passing a multitude of minute bubbles of air into the liquid through a partition of finely porous material. The apparatus for doing this comprises a sump for the spent liquid, a box or other chamber in the sump having a wall area formed of minutely porous material, and means for supplying air under pressure simultaneously to a plurality of different points within the box.

No. 235,125.

No. 14,061; June 10, 1924. Convention date, June 5, 1924.

This invention consists in the purification of the fouled air being effected by reaction between the air and the washing liquid while they are both moving in the same direction. Heretofore nearly all gas washing practice, state the patentees, has been based on the counter-current principle; but it has been found that considerable advantages accrue in this particular process from uni-directional flow. The air containing the H_2S meets completely regenerated liquid at the top of the scrubber, which liquid immediately begins to absorb the impurities, but by continued contact with the purified air is itself regenerated, so that the liquid arriving at the bottom of the scrubber is practically completely regenerated. The invention consists in the provision of static or mechanical scrubbers organized for uni-directional flow of the fouled air and the washing liquid.

No. 235,126.

No. 14,068; June 10, 1924. Convention date, June 6, 1924.

This invention consists broadly in removing the last traces of H_2S from the gas, after the greater portion has already been removed by a first washing, by subjecting the gas to a second washing employing freshly regenerated air-washing liquid. As the air-washing liquid is but slightly deteriorated by absorbing the traces of impurities remaining in the gas after its first washing, the liquid coming from the second gas washing can conveniently be conveyed direct to the air scrubber, and employed for washing the air. This method is particularly effective when carried out with a freshly precipitated iron compound. Uni-directional flow is adopted.

No. 235,127.

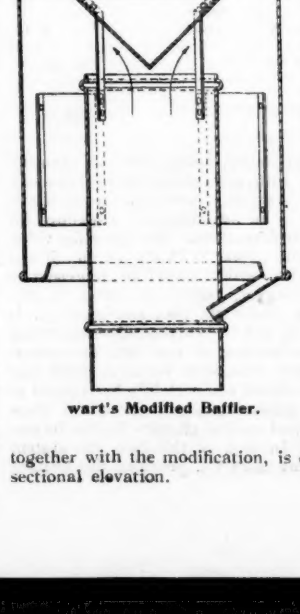
No. 14,082; June 10, 1924. Convention date, June 6, 1924.

This invention consists in recirculating the air from which the impurities have been removed back to the stream of air to which the impurities from the gases are transferred. By this operation, state the patentees, the discharge into the atmosphere of any material that might cause odour is avoided, because the air employed in the process circulates in a closed path. Absorptions of oxygen in the chemical reactions of the process are compensated by adding fresh air to the system.

Down-Draught Bafflers.—No. 241,121.

EWART, S. and J. W., of Euston Road, N.W. 1.

No. 12,994; May 18, 1925.



wart's Modified Baffler.

This invention relates to down-draught bafflers for water heaters or geysers, of the kind in which a casing or jacket surrounds and encloses the open top of the upright flue pipe, and has its lower portion open to the atmosphere and its upper end in connection with a discharge pipe in alignment with the upright flue pipe, and wherein the open top of the upright flue pipe is provided with a sheet-metal baffle of inverted cone form. With such bafflers it is found that vapour condenses on the walls of the casing, the resultant liquid running down the walls and dripping from the lower end.

The object of this invention is to overcome this disadvantage by collecting and directing the liquid of condensation from the casing into the upright flue pipe. Thus the casing is provided at its lower end with a trough or gutter to receive the liquid of condensation, which runs down the inner surface of the casing; and a pipe extends from the trough to the flue pipe.

The form of baffler referred to, together with the modification, is clearly shown in the accompanying sectional elevation.

LEGAL INTELLIGENCE.

HUYTON AND ROBY GAS COMPANY v. LIVERPOOL CORPORATION.

Injury to Gas Mains.

In the Court of Appeal on Friday, Nov. 20, consisting of Lord Justice Bankes, Lord Justice Warrington, and Lord Justice Scrutton, judgment was delivered in the case of *The Huyton and Roby Gas Company v. The Liverpool Corporation*. The case was recently before the Court (when judgment was reserved) on an appeal by the Liverpool Corporation against a decision of Mr. Justice Finlay in favour of the Huyton and Roby Gas Company in an action they brought against the Corporation for damages for injury to a number of gas mains at Roby in 1923 and 1924. The Judge awarded the Company £80 and costs. The case for the Gas Company was that the damage to their mains arose out of the action of the Corporation in laying a new water main; and the appeal was brought on the ground that the Company's claim was barred under the Public Authorities Protection Act, as not having been brought within six months. The Corporation contended that the statutory six months began to run when the act or default was committed, and the writ in the action was not issued till December, 1924.

Lord Justice BANKES, in giving judgment, said that, in the present case, but for the argument founded on the provision of the Waterworks Acts, it would seem plain that the omission to give, or to restore, the necessary support to the gas pipes was a continuing breach of duty certainly down to the time when the fractures to the gas pipes occurred and the omissions were made good. It was said, however, that the effect of the Waterworks Clauses Act was to absolve the defendants from any responsibility for the condition of the road, and the excavations which had been made, after a certain period, and that as from that date the defendants' duty in regard to the plaintiffs' pipes ceased, and that there could therefore be no continuing breach of duty. He did not think this argument could be supported. It was, no doubt, correct to say that the defendants were not entitled of their own motion, and without applying for the necessary permission at the time when the fractures occurred, to break up the streets for the purpose of making good the omissions of their contractors. This, however, was a very different thing from saying that those omissions were in consequence wiped out as breaches of duty in spite of the difficulty (if any) there might have been in making them good. For these reasons he considered that the plaintiffs established the necessary continuing breaches of duty, with the resulting damage, down to a time within six months before the commencement of the action, and that the action consequently was maintainable. The appeal therefore failed, and must be dismissed with costs.

Lords Justices Warrington and Scrutton concurred; and the appeal was accordingly dismissed with costs.

MISCELLANEOUS NEWS.

BRITISH SULPHATE OF AMMONIA FEDERATION, LTD.

The Fifth Annual General Meeting of the Federation was held on Thursday last at No. 30, Grosvenor Gardens, S.W. 1—Mr. D. MILNE WATSON (Chairman) presiding.

The annual report of the Council and Executive Committee was given in last week's "JOURNAL," p. 451.

INCREASE IN CONSUMPTION.

The CHAIRMAN said that the outstanding feature in the sulphate of ammonia market in the year under review had again been a large increase in consumption and a fall in price. The increase in consumption amounted to about 11 p.ct. on last year's figures, and those figures were in turn about 8 p.ct. higher than during the previous year. While this increase in consumption was satisfactory in itself, it was regrettable that it had to be secured at so heavy a sacrifice in price at a time when the other products of most of the manufacturers concerned were yielding very small, if any, returns. The report made it clear why they had not been able to secure a better price. The chief reason was that the output of nitrogen in the United Kingdom was only about one-tenth of the production of nitrogen in the world, excluding Chilian nitrate of soda. It was obvious, therefore, that they could only have a small voice in fixing the general level of price. Prices during the past year had been fixed chiefly in relation to the internal price of nitrogen for home consumption in Germany. Under present conditions Germany was forced to make every effort to avoid importing food, and she could only succeed by providing her farmers with abundant and cheap nitrogen. As the total quantity of nitrogen consumed in Germany for agricultural purposes was about one-third of the total consumption of nitrogen in the world, it was obvious that the price fixed for home consumption in Germany must have a determining effect on the price of nitrogen in all other countries.

IMPORTANCE OF CO-OPERATION.

If, on the one hand, it was a fact that they were unable to influence the general level of nitrogen prices, yet, on the other, he thought it was clear that their output was sufficiently large in itself to make it absolutely necessary that the selling should be in the hands of one central body like the Federation. It was safe to predict that, if the Federation did not exist, there would be constant and large fluctuations in the price of British sulphate of ammonia.

In 1920 the price of sulphate to farmers in this country was £23 11s. per ton. For the year under review it was, on an average, about £14 10s. per ton; for the current seaon it was about £13 per ton. There was no doubt room for a considerably larger consumption of nitrogen in this country than was at present being attained. With an arable acreage of just under 14 million acres, Great Britain last year consumed about 35,500 tons of pure nitrogen, of which 27,300 tons was in the form of sulphate of ammonia. This represented a consumption of nearly 6 lbs. of pure nitrogen per arable acre. Germany last season used 11 lbs. of pure nitrogen per acre of arable land; and there was every indication that this quantity would be largely increased during the present season. Recent experiments indicated that there was a large field for the increase of nitrogen in this country on grassland. There were at present 16½ million acres under grass in Great Britain, partly permanent pasture and partly meadowland. If only one-quarter of the grassland was dressed with nitrogen at the same average rate as the arable land, a new market for over 10,000 tons of pure nitrogen per annum would be opened-up. The Chairman said he thought that the prospects for an increase in the consumption of sulphate of ammonia at home were encouraging. The fact that they delivered 153,000 tons to farmers in Great Britain and Ireland last season—an increase of 10,000 tons over the previous year, and an increase of upwards of 100,000 tons over the pre-war figure—showed that something had been done towards stimulating the home market, and was a complete reply to those critics who during and after the war said that they were pursuing a will-o'-th'-wisp in trying to cultivate the home market.

THE FAR EAST.

Sulphate of ammonia, the Chairman remarked, remained the best form of nitrogen for use in tropical lands; and it was in the tropics that their most successful effort had lain during the past year. In his review of the position last year, he referred to China and India as markets in which an increase in consumption might be expected. At that time they had been doing propaganda work only for a few months in India, and he did not anticipate that they would make very rapid progress. The progress made, however, had been extraordinarily rapid. Whereas a few years ago practically the whole of the Indian production was being exported, competing with them in Java, last year a quantity equal to over 90 p.ct. of the Indian production was consumed in that country, and a large part of the 12,500 tons of sulphate employed on Indian soil was utilized for crops, and in districts in which it was practically unknown before. Out of this total, a quantity of about 2000 tons was sold in very small lots to Indian cultivators in the villages, and therefore represented a particularly valuable effort from a propaganda point of view, which they hoped would lead to a large increase in the use during the coming year. Up to the time of the recent political disturbance they were also making satisfactory progress in China; and he had every hope that the Chinese market would in future provide a valuable outlet for their increasing production.

On the whole, he thought they could fairly claim that the Federation had made satisfactory progress during the past year, and the slight increase in membership which had taken place showed that this view was shared by makers of sulphate of ammonia who had not yet experienced the advantages of membership. The percentage of the makers in the United Kingdom who were not yet members was a diminishing one. They were convinced that they would find that it was to their advantage to be members of the Federation.

On the motion of Mr. A. READ (Bolckow Vaughan & Co., Ltd.), seconded by Mr. W. PHILLIPS (Luton Gas Company), the meeting then unanimously re-elected Mr. D. Milne Watson Chairman, and Mr. E. J. George (Consett Iron Company, Ltd.) and Mr. S. Henshaw (Staffordshire Chemical Company (1917), Ltd.) Vice-Chairmen, for the ensuing year.

All-Gas and All-Electric Houses at Leeds.—The Leeds Corporation Improvements Committee last week instructed the City Engineer (Mr. W. T. Lancashire) to prepare plans for close upon 100 houses, the bulk of which will be fitted exclusively with in some cases gas and in others electricity. They will have only one open fire—in the kitchen. It is the experimental stage of a proposed joint scheme of the Improvements, Gas, and Electricity Committees of the Corporation to develop all-gas and all-electric houses in further housing schemes.

Gloucester Gas Company.—The 17th annual meeting of the Company's Profit-Sharing Scheme was held on Nov. 6—Mr. J. H. Jones presiding. The statement of accounts for the year ended June 30 was presented, and the Directors declared a bonus of 5¾ p.ct. on the total wages earned by the members. On this basis the amount to be divided among the 190 members was £1542. Since the last meeting the trustees had invested £275 in consolidated ordinary stock of the Company, and £2200 had been invested in mortgages of the Company. Alluding to the funds still in hand, the Chairman said that on the trust account they had £4276, and on the withdrawal account £2729. The savings account stood at £1812, making a total of £8817. This was after withdrawals of £4000.

GAS REGULATION ACT APPLICATIONS.

There have appeared in the "London Gazette" the following notices regarding applications to the Board of Trade under the Act.

AMENDING ORDER.

Gas Light and Coke Company.

The Company have applied to the Board of Trade for an Amending Order providing for the revision of the standard price prescribed by the Gas Light and Coke Company (Charges) Order, 1921, as amended by the Gas Light and Coke Company (Charges) Amending Order, 1923.

The standard price now authorized in respect of the supply of gas by the Company is 11d. per therm; and the price which they have asked the Board of Trade to substitute for this is 11·4d. per therm.

SPECIAL ORDERS.

Brentwood Gas Company.

To authorize the Company to purchase the undertaking of the Ingatestone and Fryerning Gas Light and Coke Company, Ltd., upon such terms and conditions as have been agreed between the Company and the Ingatestone Company, or as may be prescribed by the Order; to extend the limits of supply, and make provision as to the price to be charged for gas in the extended limits; and to authorize the Company to use scheduled land for gas purposes.

Liverpool Gas Company.

To transfer to the Company the undertaking of the Woolton Gas Company; to authorize them to charge differential prices within the new limits; to increase the borrowing powers of the Company; to impose certain obligations on consumers; and for other purposes.

North Middlesex Gas Company.

To provide for the conversion and consolidation of the ordinary stock and other capital, to increase the capital and borrowing powers of the Company, to make provision as to reserve and renewal funds and application of profits, and for other purposes.

Borough of West Bromwich.

To enable the Corporation to borrow more money, and for other purposes.

DECLARATION OF CALORIFIC VALUE.

Helston Corporation.—500 B.Th.U. (Jan. 1, 1926).

SOME RECENT GAS EXHIBITIONS.

Nov. 15 to 20 constituted Atherton's (Lancs.) Health Week; and in connection with this event an exhibition was held at the local Volunteer Hall. Here the advantages of gas in the promotion of "healthy, happy homes" was prominently featured by the Urban District Council Gas Department. Among other events, cookery demonstrations were organized; and these, as is usual, attracted considerable interest. A striking display of Richmond's "Bungalow" and "Ranelagh" cookers, also their "Marlborough" and "Period" series of gas fires, formed a prominent feature of the gas exhibit which drew much favourable comment. The extremely good attendance throughout the week must have been gratifying to the organizers of this exhibition.

Alderman J. H. Burton, J.P., C.C., performed the opening ceremony of a gas exhibition held in the Town Hall, Beaumaris, from Nov. 11 to 24. Messrs. John Wright & Co., of Birmingham, were the sole manufacturers exhibiting; and they are to be congratulated on the attractive selection of apparatus they had to show. Gas cookers were represented by the "New World," "New World Junior," "New Eureka," and "Black Prince" cookers; and for fires there was their artistic "Classic" series of grates. Visitors interested in wash boilers, gas irons, boiling burners, &c., were adequately catered for. The exhibition should do much to further the interests of gas in Beaumaris.

A gas exhibition was held in Coatbridge Town Hall from Nov. 16 to 21; the opening ceremony being performed by Provost Kirk. During the week Miss E. M. Dodds gave a series of cookery lectures and demonstrations, which were well attended. A good selection of gas apparatus by Messrs. Main, Stoves Ltd., and John Wright & Co. was exhibited; the last-named firm's display including "New World" and "New World Junior" cookers, the "Classic" series of gas grates, in special colour finishes as well as the usual black, and also various radiators, wash boilers, &c.

An interesting gas exhibition was held at the Victoria Hall, Lampeter, from Nov. 16 to 21; Major J. C. Halford (Chairman of the Gas Company) officiating at the opening. Messrs. Arden Hill & Co., of Birmingham, were the only gas apparatus manufacturers exhibiting; and visitors had an attractive display put before them. There were "New World" and "New World Junior" cookers (with automatic heat-controlling device), also "New Compact," "Sable Knight," and "Sable Knight Eye-Level" cookers. The fire section was given over to a selection of the firm's "Regal" series of gas grates in black and special colour finishes. Other apparatus consisted of "Mars" gas-heated steam radiators, gas irons, &c. During the week a series of cookery lectures was given by Miss Sanderson.

Birmingham Gas Department's Records.—Last week the Department set up a record week's output. The total output was 339,421,000 c.ft.; the previous highest total being 334 millions in the week ended Jan. 12, 1918.

NORTH-EAST COAST COAL TRADE.

From our Own Correspondent.

The coal market was inclined to ease off at the end of the week, and the tone was not quite so steady. Shipping difficulties were responsible for a certain amount of weakness in the spot position, the weather again causing delay in the arrival of tonnage, so that prompt cargoes were offering at reduced figures. But, in addition to this, the general inquiry was reported to have been less than in recent weeks, and orders were not coming in so freely.

Northumberlands have been the chief sufferers; but some of the better-class Durham gas collieries have been short of tonnage, and have even experienced idle time. It is hoped that this is only a temporary matter, and that, with less foggy weather conditions, the position will improve again. Best sorts are well sold to the end of the year, and it is the poorer classes which will be affected if trade falls off.

Wear Special gas makes quote 16s. 6d. to 16s. 9d., and best qualities are called 16s. 3d. f.o.b. Second-class gas still maintain 14s. 9d. to 15s. Unscreened coking is 15s. to 15s. 6d. f.o.b., and best bunkers are 15s. 6d. to 15s. 9d.

YORKSHIRE AND LANCASHIRE COAL TRADE.

From our Local Correspondent.

House coals in Yorkshire and Lancashire have moved rather freely, but probably not to such an extent as may have been expected owing to the weather conditions. It is, however, becoming apparent that householders are inclined to purchase lower-grade qualities at a cheaper price. This may be accounted for by the approaching Christmas holidays.

The industrial situation has somewhat improved; but it is problematical whether it is an indication of increased tonnage or the renewal contract period that is ahead in many instances. In some areas, however, there is certainly a more optimistic tone, and it is felt that with the turn of the year better times may arrive. Collieries have been congested during the past week with traffic that could not be removed owing to fog, and delays in delivery have taken place which have rather complicated the usual working. In consequence many pits have had to "play" owing to shortage of wagons.

Gas coals do no show any appreciable difference in price.

Exports are rather weaker. Some of the principal brands which have been firm during the past three or four weeks show a slight decline, together with furnace coke.

The following are the Humber bunker and export prices (f.o.b. usual shipping ports): South Yorkshire—Hards, Association, 18s. 3d. to 18s. 4½.; screened gas, 17s.; washed trebles, 19s. 3d. to 19s. 9d.; washed doubles, 18s. 3d. to 18s. 6d.; washed singles, 17s. 9d. to 18s. 3d.; washed smalls, 13s. 3d.; rough slack, 9s.; smithy peas, 18s. 3d. to 20s. per ton. West Yorkshire—Hartleys (f.o.b.) Goole, 16s. to 17s.; screened gas, 16s. 6d.; washed trebles, 17s. 6d. to 18s.; washed doubles, 17s. 3d. to 17s. 6d.; washed singles, 16s. 6d.; washed smalls, 12s. 6d.; unwashed doubles, 13s. to 14s.; rough slack, 9s. 6d.; coking smalls, 9s. per ton. Derbyshire and Nottinghamshire—Top hards, 19s. to 20s.; washed trebles, 18s. 6d.; washed doubles, 17s. 6d. to 18s.; washed singles, 16s. 6d. to 17s.; washed smalls, 12s. 6d. to 13s. 3d.; unwashed doubles, 13s. to 15s.; rough slack, 8s. 9d. to 9s. 3d. per ton. Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, 16s. to 17s.; gas coke, 23s. 6d. to 26s. 6d.; furnace coke, 19s. 6d. to 21s. 6d.

COAL TRADE IN THE MIDLANDS.

From our Local Correspondent.

There has been a better call for fuel, not only from the domestic consumer whose requirements depend upon the weather, but also from the manufacturers. The stimulus, coinciding with an increased consumption by the public lighting and heating services, has made the collieries much busier. At many pits where there was slackness a week or two ago full time is now being worked. Stocks have been drawn upon considerably, though they are still heavy in some directions. While perennial pressure has been relieved, fog has interfered with mobility of traffic; so that high-grade house coal is difficult to supply as fast as it is called for. Congestion has by no means disappeared. Suppliers whose trade ranges over a wide area state that in London sales are slower than in some other districts. Only a moderate demand is reported for the cheaper descriptions of household coal. Beans and D.S. nuts are still plentiful. Slack is being taken up more freely, but supplies exceed the demand. Blast furnace coke is firm.

TRADE NOTES.

Joseph Taylor's Acid Tanks.

Messrs. Joseph Taylor (Saturators), Ltd., of Blackhorse Street Mills, Bolton, have recently been entrusted with a number of orders from gas-works, coke-ovens, and oil paint works for their acid tanks. Among the gas-works supplied are: The Bournemouth Gas and Water Company, the Harrow and Stanmore Gas Company, and the Barrow-in-Furness Gas Company. An illustration of one of the tanks recently supplied by the firm appears on page 484.

CONTRACTS OPEN.

Gas Meters.

The Gas Department of the Borough of Walsall are inviting tenders for a twelve months' supply of gas meters. [See advert. on p. 534.]

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Nov.* 23.

There is considerable activity in the pitch market, and prices have moved up once more, the current value being 47s. 6d. per ton in bulk at makers' works, at which figure business is reported as having been done.

Creosote is steady and unchanged at 7¼d. to 7½d. per gallon.

There is a fair amount of inquiry for pyridine, and the price is steady at 19s. 6d. to 20s. per gallon.

Pure benzole and pure toluole are firm at 2s. 1d. to 2s. 2d. per gallon, and 95/160 solvent naphtha at 1s. 10d. per gallon, filled into buyers' drums at makers' works.

Tar Products in the Provinces.

Nov. 23.

The average values for gas-works products during last week were: Gas-works coal-tar, 31s. 6d. to 36s. 6d. Pitch, East Coast, 44s. to 45s. f.o.b. West Coast—Manchester, 38s. 6d. to 39s. 6d.; Liverpool, 39s. 6d. to 40s. 6d.; Clyde, 42s. to 43s. Benzole, 90 p.ct. North, 1s. 7½d. to 1s. 8½d.; crude, 65 p.ct., at 120° C., 1s. to 1s. 1d., naked at makers' works; 50-90 p.ct., naked, North, 1s. 7½d. to 1s. 8½d. Toluole, naked, North, 1s. 6½d. to 1s. 7½d., nominal. Coal-tar crude naphtha, in bulk, North, 7½d. to 8¼d. Solvent naphtha, naked, North, 1s. 4½d. to 1s. 6d. Heavy naphtha, North, 1s. to 1s. 2d. Creosote, in bulk, North, liquid, 6¼d. to 6⅜d.; salty, 6d. to 6¼d.; Scotland, 5¾d. to 6d. Heavy oils, in bulk, North, 6¼d. to 6¾d. Carbolic acid, 1s. 4d. to 1s. 5d. prompt. Naphthalene, £11 to £14; salts, £4 to £5, bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Frost Affects Gas Supply.—The exceptionally keen frost in West Yorkshire last week effected a temporary stoppage of the gas supply at Hebden Bridge, owing to the governors in the meter house becoming frozen during the night. During the morning this was remedied.

Cardiff Gas Light and Coke Company.—At an Engineering Exhibition which is to be held in the Drill Hall, Cardiff, from Nov. 26 to Dec. 5, the Company will have a stand on which the use of gas for industrial operations will be illustrated by two typical furnaces made by British Furnaces, Ltd. One of the appliances is designed for operation over a wide range of temperature (600° to 1350° C.), and the other is a portable rivet heater. A small National gas engine will be shown driving a blower. A gas-heated steam boiler will be exhibited as a typical example of a clean and simple method of raising steam without labour. Gas coke graded for industrial use will also be demonstrated.

The Campbeltown Town Council have reduced the price of gas by 5d. per 1000 c.ft., making the charge 5s. 5d.

The formal handing-over ceremony took place on Nov. 16, at the Ulverston District Council Gas-Works, of mechanical retort charging plant, installed at a capital cost of some £2000, by Messrs. Morris & Co., of Loughborough.

An interesting feature of the recent seventh annual concert of the Gas-Works Athletic and Social Club, Richmond (Surrey), was a presentation by the members to five of their comrades who have recently retired on pension. The gift to each took the form of a set of pipes, tobacco jar, and ash tray, together with a framed record suitably worded.

NEW EDITION.

GAS *versus* ELECTRICITY.

By "PLANET."

The article by a member of the staff of an Electricity Undertaking which appeared in the "JOURNAL" for July 1 last (pp. 31 and 32) has been reprinted in 8vo. size.

Excellent Propaganda for Gas Undertakings. Price 8/4 per 100.

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STOCK MARKET REPORT.

WITH the exception of the demand for shares in the Rubber Market, the conditions on the Stock Exchange last week were of a humdrum nature. Prices moved within narrow limits, and business was dull and uninteresting. With Rubber, however, the spectacular advance on Monday in the spot price of the commodity to 4s. 7d. per lb., a further rush for shares was started. A fall in price on Wednesday was followed by a record of 4s. 8d. per lb. on Friday; and the week closed with speculators clamouring for shares and the market stronger than ever.

The Gas Market pursued the even tenor of its way, and further improvements were recorded. Altogether seven quotations of English Companies were advanced, and there were no set-backs. It will be seen from the Table that the Brentford "A" and "B" Stocks are now quoted at 100-105. This Company as a separate undertaking has only a few weeks more of existence. The yield at the average price is about £5 19s. and £5 19s. 6d. respectively on the two classes of stock. It may be of interest to our readers to know that on conversion to £120 Gas Light ordinary, the yield on that Company's statutory dividend for the current half-year is only £5 14s. p.ct. per annum, but there is the difference in the capital value, which, calculated on the present average quotations, is £1 18s.

The following transactions were recorded during the week:

On Monday, Alliance and Dublin 69⅝, 70⅛, 70¼, Bombay 19s. 3d., Brentford "A" 102½, "B" 102½, Brighton and Hove original 172, Cape Town 4½ p.ct. 1st mort. debenture 72½, 73, Continental Union 38, European 6½, Gas Light and Coke 85¼, 85½, 86¼, 86½, 3 p.ct. debenture 60⅜, Hongkong and China 19⅞, Imperial Continental 142, 144, Montevideo 70⅜, 71½, Primitiva 12s. 3d., 12s. 4½d., 12s. 6d., 12s. 7/16d., 12s. 9d., South Metropolitan 93, 93¼, 3 p.ct. debenture 58½, Tottenham 4 p.ct. debenture 76. Supplementary prices, Cape Town 5 p.ct. mort. debentures 72½, Croydon 4 p.ct. debenture 72½, 73½, Derby 5 p.ct. 107½.

On Tuesday, Alliance and Dublin 69⅝, 70, 70⅛, 70¼, Brentford "A" 104, Brighton and Hove original 171, British 106, 106½, 7 p.ct. preference 122½, 4 p.ct. debenture 74, Commercial 3½ p.ct. 83½, Gas Light and Coke 85½, 85⅝, 86, 86⅛, 87, 4 p.ct. preference 79½, 3 p.ct. debenture 61½, Hongkong and China 20, 20¼, Imperial Continental 142½, Malta and Mediterranean 86s. 3d., Oriental 104½, 105, Primitiva 12s. 4½d., 12s. 5¼d., 12s. 6d., 12s. 9d., South Metropolitan 93¼, 94, 6½ p.ct. debenture 103⅜, South Suburban 5 p.ct. 100, Tottenham "B" 87. Supplementary prices, North Middlesex 5 p.ct. preference 90¾, Wandsworth 3½ p.ct. new 96½.

On Wednesday, Alliance and Dublin 70½, Bombay 19s., 19s. 3d., Brentford 4 p.ct. debenture 79⅜, Brighton and Hove original 173, Gas Light and Coke 86, 86¼, 86½, 86⅜, 3½ p.ct. maximum 60⅛, 4 p.ct. preference 79½, 3 p.ct. debenture 60, 61, Imperial Continental 142½, 143½, Primitiva 12s. 3d., 12s. 4½d., 12s. 6d., 12s. 7½d., 12s. 9d., 4 p.ct. (Buenos Ayres) debenture 66, 67, 4 p.ct. (1911) debenture 65, 66, South Metropolitan 93½, 94, 94½, South Suburban 5 p.ct. 100, 101, 5 p.ct. debenture 97, Southampton 4 p.ct. debenture 74, Tottenham "B" 87, 90, Tuscan 20s., 6 p.ct. debenture 70.

On Thursday, Alliance and Dublin 70½, 71, Bombay 19s., 19s. 3d., Bournemouth 5 p.ct. 12½, "B" 12⅜, Brighton and Hove original 172, 172½, Commercial 3½ p.ct. 83, Croydon maximum dividend 84, Gas Light and Coke 86, 86⅛, 86⅜, 87, 4 p.ct. preference 79½, Imperial Continental 138, 139, 140½ *ex div.*, Primitiva 12s. 6d., 12s. 7½d., 12s. 9d., San Paulo 6 p.ct. preference 7⅞, South Metropolitan 93½, South Suburban 5 p.ct. 102½, 5 p.ct. debenture 101, Tottenham "B" 90. Supplementary prices, Hartlepool 5 p.ct. ordinary 87, 87⅜, Southend-on-Sea 4 p.ct. debenture 71½, 72.

On Friday, Commercial 3 p.ct. debenture 57⅜, 58¼, Gas Light and Coke 86½, 86⅜, 87, 87⅛, 3 p.ct. debenture 61½, 61⅛, Imperial Continental 139, 140½, 141. Newcastle-upon-Tyne 70⅜, Primitiva 12s. 4½d., 12s. 6d., 12s. 6½d., 12s. 9d., South Metropolitan 93½, 93⅜, 6½ p.ct. debenture 104, Tottenham "B" 91. Supplementary prices, Brighton and Hove 4 p.ct. debenture 76, Hartlepool 5 p.ct. 88½.

The apprehension of an advance in the Bank Rate affected Lombard Street last week, to which the rise in the Philadelphia Reserve Bank rate contributed. Discount brokers generally quoted 3⅛–⅜ p.ct. as their buying rate, and Treasury Bill allotments produced the higher average rate of £3 18s. 5·17d. p.ct. Loanable credits were plentiful, and day-to-day loans were renewed at 3 p.ct.

Sterling was firmer and closed at 4·84⅛–⅜. French francs were a little steadier during the week; but on Saturday a fresh record was touched at 120.05. Belgian francs were quoted at 106.85-107.00; and the Milan rate hardened to 120¾.

Silver was dull on Chinese selling, and the price declined to 32d. per oz. Gold remained unchanged at 84s. 11½d. per oz.

The Bank Rate is 4 p.ct., to which it was reduced from 4½ p.ct. on Oct. 1. Bankers' deposit rates are 2 p.ct. The deposit rates of the discount houses are 2 p.ct. at call and 2¼ p.ct. at notice.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Nov. 20.	Rise + or Fall − on Week.	Transactions Lowest and Highest Prices.
£			%p.a.	%p.a.				
171,978	Stk.	Aug. 13	5	5	Aldershot 5 p.c. max. C.	75—78	..	..
295,492	,,	,,	4	4	Do. 4 p.c. Pref.	70—75	..	..
1,551,868	,,	Oct. 8	6½	6½	Alliance & Dublin Ord.	68—72	..	69½—71
374,000	,,	July 9	4	4	Do. 4 p.c. Deb.	60—65	..	..
300,000	1	Oct. 22	1/7⅛	1/7⅛	Bombay, Ltd.	⅞—1	..	19/—19/3
170,000	10	Aug. 13	8½	8½	Bournemouth 5 p.c.	12—13	..	12½
425,030	10	,,	7	7	Do. B 7 p.c..	12—12½	..	12½
150,000	10	,,	6	6	Do. Pref. 6 p.c..	11—12	..	..
50,000	Stk.	June 25	3	3	Do. 3 p.c. Deb.	56—59	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb..	77—80	..	..
992,045	,,	July 9	6 1/16	6 1/16	Brentford A Con.	100—105	+2	102½—104
990,500	,,	,,	6⅛	6⅛	Do. B New	100—105	+2	102½
76,000	,,	,,	5	5	Do. 5 p.c. Pref.	95—98	..	..
306,690	,,	June 11	4	4	Do. 4 p.c. Deb.	76—81	..	79½
181,337	,,	,,	6	6	Do. 6 p.c. Rich. Red. Deb.	100—105	..	..
214,740	,,	Aug. 27	12½	12	Brighton & Hove Orig.	170—175	+2	171—173
244,200	,,	,,	9½	9	Do. A Ord.	135—140	..	..
1,287,500	,,	July 23	5	5	Bristol 5 p.c. max.	89—91a	..	..
855,000	,,	Oct. 8	7	8	British Ord.	105—110	..	106—106½
100,000	,,	June 25	7	7	Do. 7 p.c. Pref..	120—125	..	122½
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	71—76	..	74
100,000	10	May 21	6	8	Cape Town, Ltd.	6½—7½	..	..
100,000	10	Nov. 5	4½	4½	Do. 4½ p.c. Pref..	6½—7½	+½	..
150,000	Stk.	June 25	4½	4½	Do. 4½ p.c. Deb..	70—75	..	72½—73
626,860	,,	July 23	6	6	Cardiff Con. Ord.	98—101	..	..
237,860	,,	June 25	7½	7½	Do. 7½ p.c. Red. Deb.	101—104	..	..
157,150	,,	Aug. 13	6½	5	Chester 5 p.c. Ord.	90—95b	..	..
1,513,280	,,	July 23	5/14/8	5½	Commercial 4 p.c. Cap.	81—86	..	..
560,000	,,	,,	5⅜	5/3/4	Do. 3½ p.c. Cap.	81—86	..	83—83½
475,000	,,	June 11	3	3	Do. 3 p.c. Deb.	56—59	..	57½—58½
800,000	,,	Oct. 8	—	4	Continental Union, Ltd.	38—41	−1	38
200,000	,,	,,	7	7	Do. 7 p.c. Pref.	87—90	..	..
660,000	,,	Aug. 13	6½	6½	Croydon sliding scale	97—101	..	..
284,975	,,	,,	5	5	Do. max. div.	81—84	..	84
492,270	,,	Aug. 13	9	6	Derby Con.	107—109c	..	107½
55,000	,,	June 25	4	4	Do. Deb.	74—76c	..	..
1,002,180	10	July 23	4	6	European, Ltd.	6½—7½	..	6½
16,460,070	Stk.	Aug. 13	5½	5½	Gas Light & Coke 4 p.c. Ord.	86—88	+1½	85½—87½
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	60—63	+1	60½
4,062,235	,,	,,	4	4	Do. 4 p.c. Con. Pref.	77—80	..	79½—79¾
4,761,930	,,	June 11	3	3	Do. 3 p.c. Con. Deb.	60—63	..	60—61½
130,000	,,	—	10	10	Do. 10 p.c. Bonds	..	..	..
42,000	,,	—	7½	*7½	Do. 7½ p.c. Ilford Deb.	..	..	..
82,500	,,	Sept. 10	6½	6½	Hastings & St. L. 5 p.c. Conv.	90—95	..	..
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	71—76	..	..
70,000	10	Sept. 24	10	10	Hongkong & China, Ltd.	19¼—20⅛	+⅛	19⅞—20⅛
86,600	Stk.	Aug. 13	10	10	Hornsey 7 p.c.	132—137	..	..
4,976,000	,,	Nov. 19	59	10	Imperial Continental Cap.	137—142*	−4	138—144
226,170	,,	Aug. 13	3½	3½	Do. 3½ p.c. Red. Deb.	70—73	..	..
235,242	,,	Aug. 13	6½	6½	Lea Bridge 5 p.c. Ord.	97—102	..	..
2,127,340	,,	Aug. 13	5½	5½	Liverpool 5 p.c. Ord.	8 4/4—85b	..	..
600,000	,,	Sept. 24	7	7	Do. 7 p.c. Red. Pref.	101¼—103½b	..	..
265,736	,,	Aug. 27	8	9	Maidstone 5 p.c. Cap.	118—128	..	..
63,480	,,	June 25	3	3	Do. 3 p.c. Deb.	55—60	..	..
75,000	5	June 25	3	7	Malta & Mediterranean	4—4½	..	£4/6/3/
541,920	Stk.	Nov. 19	4	4	Montevideo, Ltd.	66—70*	−2	70½—71½
2,061,315	,,	Aug. 13	5	5	Newcastle & Gateshead Con.	71¼—72d	+½	70½
300,929	,,	,,	4	4	Do. 4 p.c. Pref..	75½—76¼d	..	..
529,705	,,	June 25	3½	3½	Do. 3½ p.c. Deb.	68—69d	..	..
15,000	,,	Aug. 27	12	13½	North Middlesex 10 p.c.	160—170	..	..
75,940	,,	,,	8 8/16	8 2/16	Do. 7 p.c.	115—120	..	..
300,000	Stk.	May 7	9	7	Oriental, Ltd.	102—107	+2	104½—105
188,120	,,	June 25	7 7/8	7½	Plym'th & Ston'house 5 p.c.	112—117	..	..
60,000	50	Aug. 27	14	14	Portsea Island B	93—96	..	..
100,000	50	,,	13	13	Do. C	90—95	..	..
2,289,909	1	—	—	—	Primitiva Ord.	12/3—13/3	..	12/3—12/9
302,600	100	June 2	4	4	Do. 4 p.c. Red. Deb.	84—86	..	..
600,000	Stk.	July 23	4	4	Do. 4 p.c. Red. Deb. 1911	64—66	..	65—66
193,744	,,	June 25	4	4	Do. B. Aires 4 p.c. Rd. Db.	65—67	..	66—67
264,496	,,	,,	4	4	Do. R'r P'te 4 p.c. Rd. Db.	65—67	..	..
150,000	10	Sept. 24	6	6	San Paulo 6 p.c. Pref.	7½—8	..	7⅞
125,000	50	July 1	5	5	Do. 5 p.c. Red. Deb.	42—45	..	..
270,000	Stk.	Aug. 27	5½	5½	Sheffield A	99—101a	..	..
419,968	,,	,,	5½	5½	Do. B	99—100a	..	..
1,047,000	,,	,,	5½	5½	Do. C	99—100a	..	..
90,000	10	June 11	6	4	South African	7—9	..	..
6,609,895	Stk.	Aug. 13	6½	5	South Met. Ord.	93—95	+1	93—94½
1,895,445	,,	July 9	3	3	Do. 3 p.c. Deb.	57—60	..	58½
734,000	,,	Sept. 10	6½	6½	Do. 6½ p.c. Red. Deb.	103—105	+1	103½—104
91,500	,,	Aug. 13	8½	8½	South Shields Con.	130—132d	..	..
1,127,795	,,	July 23	6½	6½	South Suburban Ord. 5 p.c.	99—103	+2	100—102½
368,837	,,	June 25	5	5	Do. 5 p.c. Deb.	95—98	..	97—101
647,740	,,	Oct. 22	5	5	South'mpt'n Ord. 5 p.c. max.	78—81	..	..
121,275	,,	June 25	4	4	Do. 4 p.c. Deb.	70—75	..	74
250,000	,,	Aug. 27	7	7	Swansea 7 p.c. Red. Pref.	100—102	..	..
200,000	,,	June 25	6½	6½	Do. 6½ p.c. Red. Deb.	101—103	..	..
120,000	,,	July 23	8	7½	Tottenham District A 5 p.c.	108—113	..	..
882,275	,,	,,	6½	3½	Do. B 3½ p.c.	87—92	..	87—91
150,000	,,	July 9	—	28/4	Do. 5½ p.c. Pref.	103—105	..	..
181,255	,,	June 11	4	4	Do. 4 p.c. Deb.	76—79	..	76
258,251	,,	Aug. 27	5	5	Tynemouth Con. and New	70—72d	..	..
197,294	,,	Aug. 27	6½	6½	Uxbridge, Maidenhead, & Wycombe 5 p.c.	93—98	..	..
88,330	,,	,,	5	5	Do. 5 p.c. pref.	93—98	..	..
91,800	,,	,,	6½	6½	Do. 5 p.c. Maidenh'd	88—93	..	..
					Wandsworth, Wimbledon, and Epsom—			
30,000	,,	July 9	9½	8½	Wandsworth A 5 p.c.	128—133	..	..
255,636	,,	,,	7½	7	Do. B 3½ p.c.	109—114	..	..
392,955	,,	,,	6/9/6	5/19/0	Do. C and New	92—97	..	96½
352,000	,,	,,	7⅜	6½	Wimbledon 5 p.c.	103—108	..	..
98,000	,,	,,	7⅜	7½	Epsom 5 p.c.	113—118	..	..
88,416	,,	June 25	3	3	3 p.c. Deb.	56—59	..	..

Quotations at:—*a*,—Bristol, *b*,—Liverpool, *c*,—Nottingham, *d*,—Newcastle, *e*,—Sheffield. *Ex, div.